



Government of Karnataka

ELECTRONICS & HARDWARE

**Job Role : Field Technician other
Home Appliances
TEXT BOOK**



10th Standard



**National Skill Qualification Framework
NSQF LEVEL 2**

**Samagra Shikshana Karnataka
and
Karnataka Text Book Society (R.)**

FOREWORD

All Education commissions recommend bringing work and education into the domain of the curricular, infusing it in all areas of learning while giving it an identity of its own at relevant stages. It explains that work, transforms knowledge into experience and generates important personal and social values such as self-reliance, creativity and cooperation. Through work one learns to find one's place in the society. Work involves interaction with material or other people (mostly both), thus creating a deeper comprehension and increased practical knowledge of natural substances and social relationships.

Through work and education, school knowledge can be easily linked to learners' life outside the school. All the previous Education commissions emphasized on Vocational Education and Training (VET) for all those children who wish to acquire additional skills and/or seek livelihood through vocational education after either discontinuing or completing their school education. VET is expected to provide a 'preferred and dignified' choice rather than a terminal or 'last-resort' option. NCERT has attempted to infuse work across the subject areas and also contributed in the development of the National Skill Qualification Framework (NSQF) for the country, which was notified on 27 December 2013.

It is a quality assurance framework that organizes all qualifications according to levels of knowledge, skills and attitude. These levels, graded from one to ten, are defined in terms of learning outcomes, which the learner must possess regardless of whether they are obtained through formal, non-formal or informal learning. The NSQF sets common principles and guidelines for a nationally recognized qualification system covering Schools, Vocational Education and Training Institutions, Technical Education Institutions, Colleges and Universities. It is under this backdrop that Pandit Sunderlal Sharma Central Institute of Vocational Education (PSSCIVE), Bhopal, a constituent of NCERT has developed learning outcomes based modular curricula for the vocational subjects from Classes IX to XII. This has been developed under the Centrally Sponsored Scheme of Vocationalisation of Secondary and Higher Secondary Education of the Ministry of Education

This textbook has been developed as per the learning outcomes based curriculum, keeping in view the National Occupational Standards (NOS) for the job role and to promote experiential learning related to the vocation. This will enable the students to acquire necessary skills, knowledge and attitude.

These text books from PSSCIVE were vetted by a team of subject experts and resource persons in the context of setting a state specific content to ensure more relevancy to the world outside the school.

CHAIRMAN NOTE:

In a rapidly evolving world, the importance of vocational education has never been more pronounced. As industries adapt to new technologies and changing market demands, the need for skilled professionals who are equipped with practical knowledge and hands on experience becomes critical. The series of vocational text books aims to bridge the gap between theoretical concepts and real world application, providing learners with the tools they need to succeed in their chosen fields.

Each text book in this series has been meticulously crafted to align with industry standards and best practices. By combining foundational knowledge with practical skills we aim to empower among students to not only understand their disciplines but also to excel in them. Our contributors are experienced educators, Industry professions and subject matter experts have collaborated to ensure that the content is both relevant and engaging.

The structure of each book is designed to facilitate effective learning among students. All Key points are presented in a clear and concise manner, complemented by real life case studies, practical exercises and assessments that encourage critical thinking and problem-solving. We believe that learning is most effective when students can see the direct application of their studies in Professional settings.

We also recognize the diverse backgrounds and learning styles of our students. To that end, we have included a variety of teaching tools, including visual aids, Interactive elements, and online resources, to support a more personalized learning experience. Our goal is to make vocational education accessible and engaging for all learners, regardless of their starting point.

As you embark on this educational journey we encourage you to approach these text books with an open mind and a willingness to explore new ideas. The skills and knowledge you gain will not only prepare you for immediate employment but will also serve as a foundation for lifelong learning and professional development.

We extend our gratitude to all those who contributed to this text books, and we hope that these textbooks will inspire and equip the next generation of skilled professionals.

Welcome to the future of Vocational Education.

ABOUT THE BOOK

This book on Electronics and Hardware is a carefully compiled information to bring about an intuitive interest to the students in the concepts of usage of electrical energy to achieve desired outcomes either through product installation, service and/or repair.

Introducing the essential concepts of electrical terminologies and providing an in-depth understanding of their essence is the main aim of this book. Following the standards prescribed by the NSQF, this book tries to involve the student into the realm of electronics and hardware through various activities and exercises to ignite a level of curiosity to forge a strong career path in the field of electronics.

Understanding the working of Mixer, Juicer, Grinder and Microwave enables the student to understand the complexities of component integration and understand the intricacies of PCB designing used in the equipment. Component level troubleshooting and servicing repairs teach the students to identify and rectify any faults that arise. Inducing the knowledge for operating and troubleshooting of Mixer, juicer, grinder and microwave oven paves a pathway towards skilling a student in the servicing of home appliances and in turn build a livelihood through it.

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Unit 1



ELECTRICAL COMPONENTS AND MOTORS

Introduction

Electrical components play a major role in our day-to-day life. An electronic device is nothing without electricity. In this unit, let us discuss the various concepts of electrical components, motors and their functions.

Learning outcomes:

- 1) Understand various electromechanical components.
- 2) Understand the concept of motor

Session 1: Describe the Various Electrical Components

Electronic Component : The electronic components are the components that are connected in an electronic circuit to control and to direct the flow of current to do various functions.

Electronic components are broadly classified into three types they are,

1. Active Components
2. Passive Components
3. Electromechanical Components

Active Electronic Components : Active electronic components require an external source for operation and can amplify current and provide power gain.

Some of the common Active electronic components are

1. Diode
2. Light Emitting Diode (LED)
3. Transistor
4. Integrated Circuit.

Passive Electronic Components : Passive electronic components do not require any external source for operation and they cannot introduce power to the circuit.

Some of the common Passive electronic components are

1. Resistor
2. Capacitor
3. Inductor
4. Transformer.

Electromechanical Components : The components which take electrical energy as input and convert it into mechanical energy as an output.

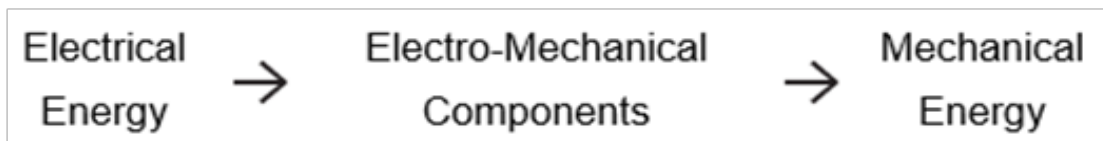


Fig 1.1: Energy transformation

Some of the common electromechanical components are

1. Motors
2. Relays
3. Circuit breakers

Electrical Components : Electrical components are the parts of an electrical circuit that control the flow of electricity and perform various functions.



Fig 1.2: Electrical components

Characteristics of Electrical Energy : The following electrical quantities of Current, Voltage, Power, Energy are used to describe the characteristic of electrical signal

Current:

Electric Current is the rate of flow of electrons through a particular point in a circuit. In simple terms current is the flow of free electrons. Current is represented by the symbol I and the unit of current is Ampere(A).

Types of Electric Current:

There are two types of electric current. They are,

1. Alternating Current (AC)
2. Direct Current (DC)

Alternating Current (AC):

AC current or alternating current is the current that periodically reverses its direction. In AC Supply there are two terminal phases, neutral. AC Supply is mainly used in House and office buildings. This is because high Voltage from power stations can be easily reduced to safer levels for use in homes.

Frequency of AC waveform:

The time taken for the ac waveform to complete one full movement that is from 0 to positive, positive to 0, 0 to negative, and negative to 0 is called cycle. The total number of cycles per second is called frequency. The unit of frequency is hertz (Hz). In our country single phase supply is maintained at 50Hz.

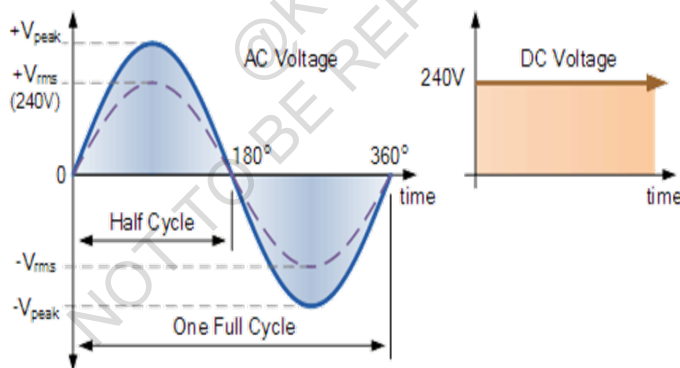


Fig 1.3: AC Waveform Fig 1.4: DC Waveform

Direct current (DC):

Direct current is the current that does not change its direction with respect to time. Direct current flows only in one direction (unidirectional flow of current). A battery is a good example of DC Supply.

Difference between AC and DC:

Alternating Current [AC]	Direct Current [DC]
1. It can be transmitted over long distances.	1. It cannot be transmitted over long distances.
2. It reverses its direction periodically.	2. It does not change its direction.
3. It is mainly obtained from AC Generators.	3. It is mainly obtained from battery or cell
4. The frequency of ac is 50Hz and 60Hz depending on the country.	4. There is no frequency for DC.
5. The magnitude of current changes with time.	5. The magnitude of the current does not change with time.

Measurement of Current:

Current is an electrical quantity. It is measured by ammeter which is of two types

- Analog Ammeter
- Digital Ammeter

Analog Ammeter:

Analog Ammeter is a device which is used to measure the current and indicate the magnitude on a calibrated scale. This can be further classified into two types

- Analog AC Ammeter
- Analog DC Ammeter

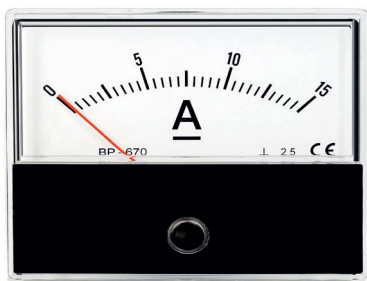


Fig 1.5: Analog AC Ammeter

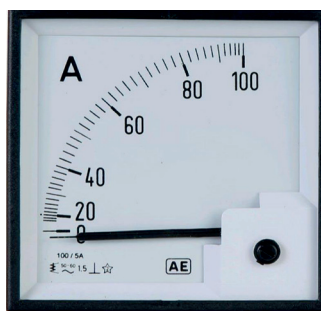


Fig 1.6: Analog DC Ammeter

Digital Ammeter:

Digital Ammeter is a device which is used to measure the current and indicate the magnitude on a digital read-out. This can be further classified into two types

- Digital AC Ammeter
- Digital DC Ammeter

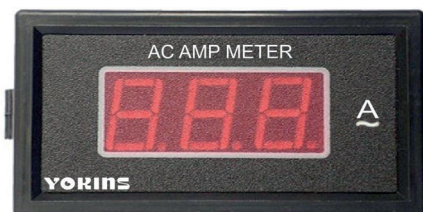


Fig 1.7: Digital AC Ammeter

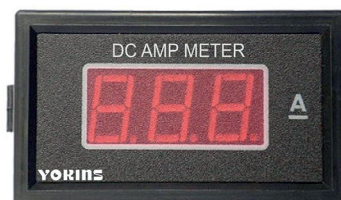


Fig 1.8: Digital DC Ammeter

Measurement of Voltage:

In order to move the electrons an electrical pressure is required and this electrical pressure is said to be voltage. Hence in an electrical circuit or in a conductor an electrical pressure, that is voltage is required to push the current in the circuit. Voltage is represented by the symbol V or E and the unit of voltage is Volt(V). Voltage is an electrical quantity, It is measured by Voltmeter. They are of two types

- Analog AC Voltmeter
- Digital AC Voltmeter

Analog Voltmeter:

Analog Voltmeter is a device which is used to measure the voltage and indicate the magnitude on a calibrated scale. This can be further classified into two types

- Analog AC Voltmeter
- Analog DC Voltmeter



Fig 1.9: Analog AC Voltmeter



Fig 1.10: Analog DC Voltmeter

Digital Voltmeter:

Digital Voltmeter is a device which is used to measure the voltage and indicate the magnitude on a digital read-out.

This can be further classified into two types

- Digital AC Voltmeter
- Digital DC Voltmeter

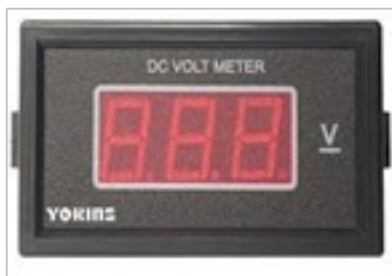


Fig 1.11: Digital DC Voltmeter



Fig 1.12: Digital AC Voltmeter

Measurement of Power:

Electrical power is the rate of doing work in a specified time, that is the amount of electrical work which is done during a specified time interval. It is represented by the symbol P and the unit of power is watts (W).

$$\text{Power (P)} = \text{Electrical Work Done} / \text{Time}$$

$$\text{Electrical Work Done} = \text{Voltage} \times \text{Current} \times \text{Time} = V \times I \times t$$

$$\text{Power (P)} = V \times I \times t / t$$

$$\text{Power (P)} = V \times I$$

Power is an electrical quantity. It is measured using Wattmeter. There are two types of Wattmeter. They are,

- Analog wattmeter
- Digital wattmeter

Analog wattmeter:

It is the type of wattmeter which measures the power and indicates the value on a calibrated scale.



Fig1.13: Analog wattmeter

Digital Wattmeter

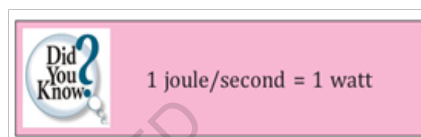
It is the type of wattmeter which measures the power in terms of digital signal. It shows the output on a digital read-out.



Fig 1.14: Digital wattmeter

Measurement of Energy:

It is defined as the capability to do work. Unit of energy is watt-hour (wh) (or) joule. Energy is an electrical quantity. It was measured by an Energy meter. There are two types of energy meters. They are, Analog energy meter and Digital energy meter



Analog Energy Meter:

It is the type of energy meter which measures the energy and indicates on a counter read out.



Fig 1.15: Analog energy meter

Digital Energy Meter:

It is the type of energy meter which measures the energy and displays the value on a digital read-out.



Fig 1.16: Digital energy meter

Resistance:

The resistance is the property of the material to oppose the flow of electrical current in a circuit or in a conductor. The electrical component with this property is known as the resistor. It is represented by the symbol R and the unit of resistance is ohm (Ω).

Wire:

It is a conductor that allows current to pass through it. All the wires are made using conducting materials such as aluminum, copper, iron etc.



Fig 1.17 : Wires

Cable:

It is a thick insulated protective wire which is used for transmitting electricity or electro-communication signals.

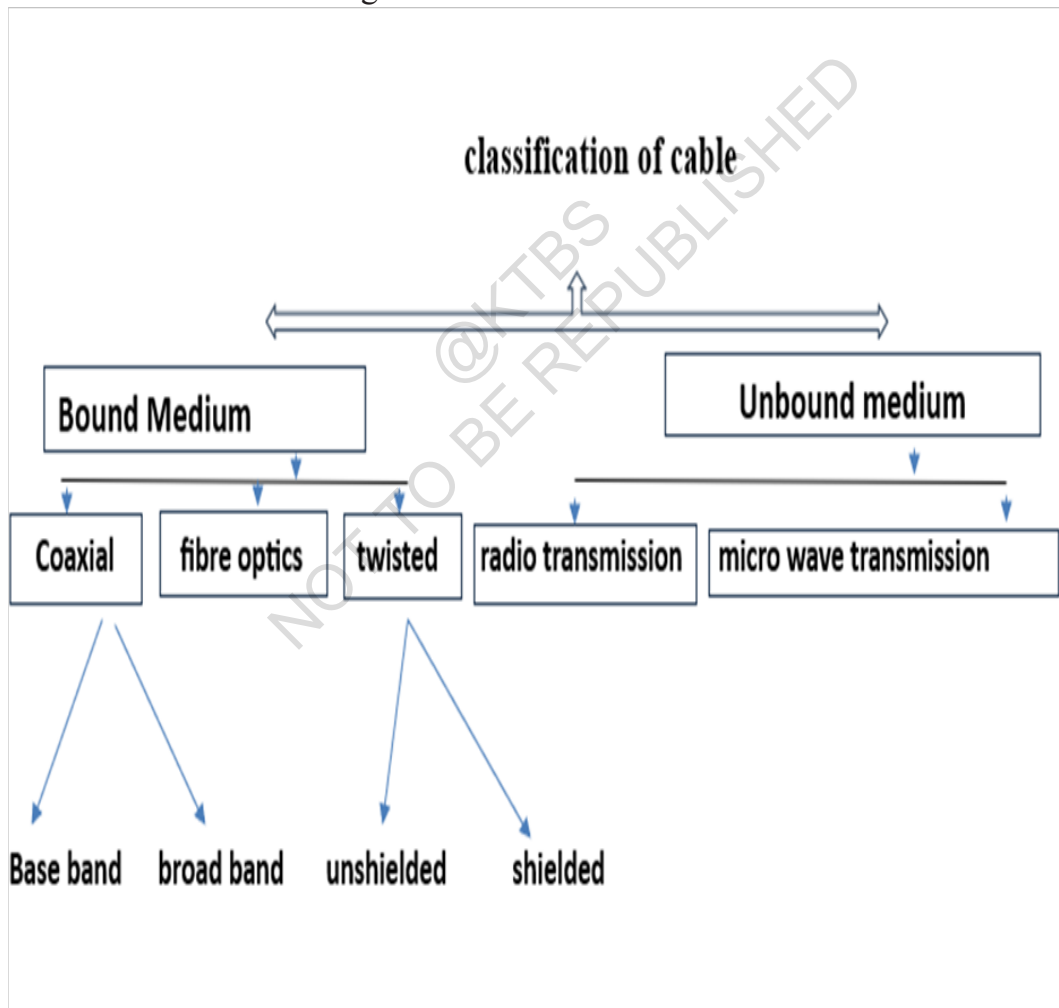


Fig 1.18: Classification of cable

Types of Cables:

Coaxial Cable -

Coaxial cable is used as a transmission line for radio frequency signals. There are two types of Coaxial cable. They are

- Baseband cable
- Broadband cable

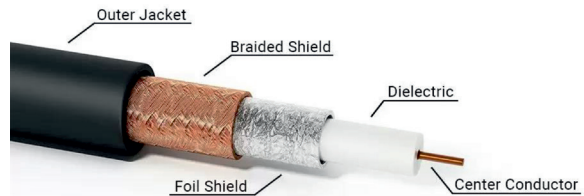


Fig 1.19: Coaxial cable

Applications:

- Antennas
- Ethernet
- Cable Television

Fiber Optic Cable -

They are designed for long distance communication. It provides higher bandwidth and can transmit data over longer distances.

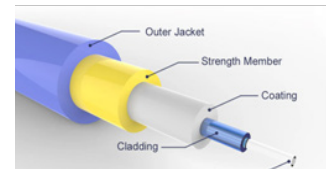


Fig 1.20 : Fiber optic cable

Applications:

- Computer Networking
- Telephone Systems
- Cable Television

Twisted Pair Cable -

Twisted pair cable is a pair of insulated wires that are twisted together to reduce transmission loss. There are two types of twisted pair cable. They are,

- Unshielded Twisted Pair cable (UTP)
- Shielded Twisted Pair cable (STP)

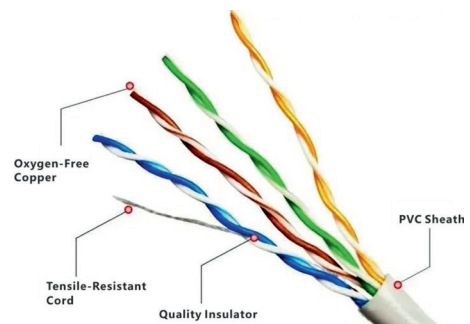


Fig 1.21 : Twisted pair cable

Applications

- Data Network
- Telephone Network
- Relay

1.3 Relay:

Relay is an electromagnetic device used to make or break the electric circuit when an energizing current is passing through it.



Fig1.22:Relay

Parts of Relay:

Electro Mechanical Relay consists of various parts such as

- Moveable armature
- Moveable contact
- Fixed contact
- Spring
- Electromagnet

Working Principle of Relay:

It works on the principle of an electro magnetic attraction. When the circuit of the relay senses the fault current, it energizes the electro magnetic field which produces the temporary magnetic field. This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contact, and the high-power relay has two contacts for opening the switch as shown in the above figure 1.23.

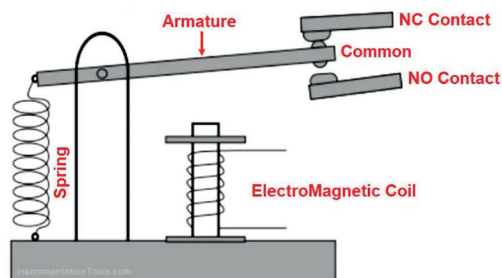


Fig 1.23 : Working principle of relay

The inner section of the relay is shown in the figure above 1.23. It has an iron core which is wound by a control coil. The power supply is given to the coil through the contacts of the load and the control switch. The current flowing through the coil produces the magnetic field around it.

Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Hence close the circuit, which makes the current flow through the load. If the contact is already closed, then it moves oppositely and hence opens the contacts

Construction of Relay:

The relay operates both electrically and mechanically. It consists of electromagnetic and sets of contacts which perform the operation of the switching. The construction of the relay is mainly classified into four groups. They are the contacts, bearings, electromechanical design, terminations, and housing.

Contacts –

The contacts are the most important part of the relay that affects the reliability. The good contact gives limited contact resistance and reduced contact wear. The selection of the contact material depends upon several factors like the nature of the current to be interrupted, the magnitude of the current to be interrupted, frequency and voltage of operation.

Bearing –

The bearing may be a single ball, multi-ball, pivot-ball and jewel bearing. The single ball bearing is used for high sensitivity and low friction. The multi-ball bearing provides low friction and greater resistance to shock.

Electromechanical Design –

The electromechanical design includes the design of the magnetic circuit and the mechanical attachment of core, yoke and armature. The reluctance of the magnetic path is kept minimum for making the circuit more efficient. The electromagnet is made up of soft iron, and the coil current is usually restricted to 5A and the coil voltage to 220V.

Terminations and Housing –

The assembly of an armature with the magnet and the base is made with the help of spring. The spring is insulated from the armature by molded blocks which provide dimensional stability. The fixed contacts are usually spot welded on the terminal link.

Applications of Relays:

Relays are used in many applications. Some of them are listed below

- Stabilizers
- Telephone exchanges
- In computer to perform logical operations
- Used in circuit breakers

Types of Relays:

There are two types of relays. They are as follows

Electro-Mechanical Relay -The relay is an electromechanical switch used as a protecting device and as a controlling device for various circuits.

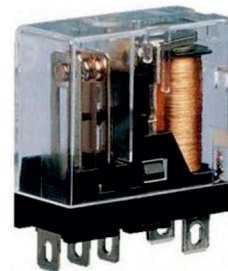


Fig1.24: Electro mechanical Relay

Static Relay -A static relay is a type of relay that acts as an electrical switch that has no moving parts.



Fig 1.25: Static relay

1.4 Circuit Breaker :

Circuit breaker disconnects the circuit automatically when the fault occurs. It is used for Switching, controlling, and protecting operations of electrical circuits.

Working: The moving contact is fixed with the relay coil or trip coil. Under fault conditions the relay coil gets energized and pulls the moving contact from the fixed contact. So, the equipment is disconnected from the electric supply. They are used in homes, factories, power stations, hotels, etc.



Fig 1.26 : Types of Circuit Breaker

Fuse - A fuse is a protective device used for protecting electrical circuits. It disconnects the circuits when high current flows.



ACTIVITY 1

Role Play

Identify the parts of a Relay.

Materials Required

Relay, A4 sheet, Pen

Procedure

1. Form eight groups with at least 5 members in each.
2. Give various parts of relay to the students.
3. Instructions given by the teacher to the students to write the name of the parts.

ACTIVITY 2

Role Play

Identify the parts of a Circuit Breaker.

Materials Required

Circuit Breaker, A4 sheet, pen.

Procedure

1. Form eight groups with at least 5 members in each.
2. Give the various parts of Circuit breaker to the students.
3. Instructions given by the teacher to the students to write the name of the parts.

ACTIVITY 3

Role Play

Identify the different parameters of a Circuit Breaker.

Materials Required

Circuit Breaker, A4 sheet, pen.

Procedure

1. Form eight groups with at least 5 members in each.
2. Give the various types of Circuit breakers to the students.
3. Instructions given by the teacher to the students to note down the parameters of the Circuit Breaker.

ACTIVITY 4

Role Play

Identify the parts of a fuse.

Materials Required

Fuse, A4 sheet, pen.

Procedure

1. Form eight groups with at least 5 members in each.
2. Give the various types of fuses to the students.
3. Instructions given by the teacher to the students to write the parts of each type of fuse.

CHECK YOUR PROGRESS

Choose the correct answers

1. The SI unit of current is
 - a. Ohm
 - b. Watt
 - c. Joule
 - d. Ampere

-
-
2. The formula to find voltage is
a. $V=W/Q$ b. $I=Q/T$ c. $R=V/I$ d. $P=VI$
 3. What is the frequency of AC in India is
a. 30Hz b. 80Hz c. 50Hz d. 60Hz
 4. Energy is measured using
a. Watt meter b. Ohm meter c. Volt meter d. Energy meter

Fill in the blanks

1. A type of relay which has no moving part is _____.
2. A thick insulated protective wire which is used for transmitting electricity or telecommunication signals is _____.
3. The bearing used for high sensitivity and low friction is _____.
4. The device used to make or break the electric circuit when an energizing current is passing through it is _____.
5. The component which takes electrical energy as input and converts it into mechanical energy as an output is _____.

Answer the following questions:-

1. Write the applications of relay.
2. What is fuse? List the types of fuse.
3. What is an electronic component?
4. What is an active component? Give an example.
5. What is a passive component? Give an example.
6. Write the working principle of circuit breaker.
7. Draw the diagram of the relay.
8. Write the working principle of relay.
9. List the parts of the circuit breaker.

Session 2: Appreciate the concepts of Motor

Electric Field:

It is a medium around a charge (or) region in which the electric force acts is called electric field.

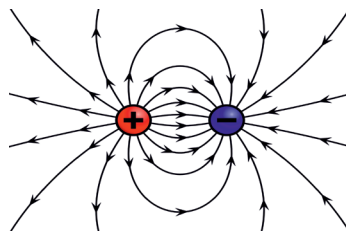


Fig 1.28(a): Electric field

Magnetic Field:

Magnetic flux lines around a magnet are called magnetic fields.

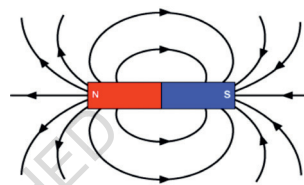


Fig 1.28(b): Magnetic field

2.1 Electromagnetic Induction:

Electromagnetic induction is the production of an electromotive force (i.e., voltage) across an electrical conductor in a changing magnetic field. It is based on the principle of Faraday's law

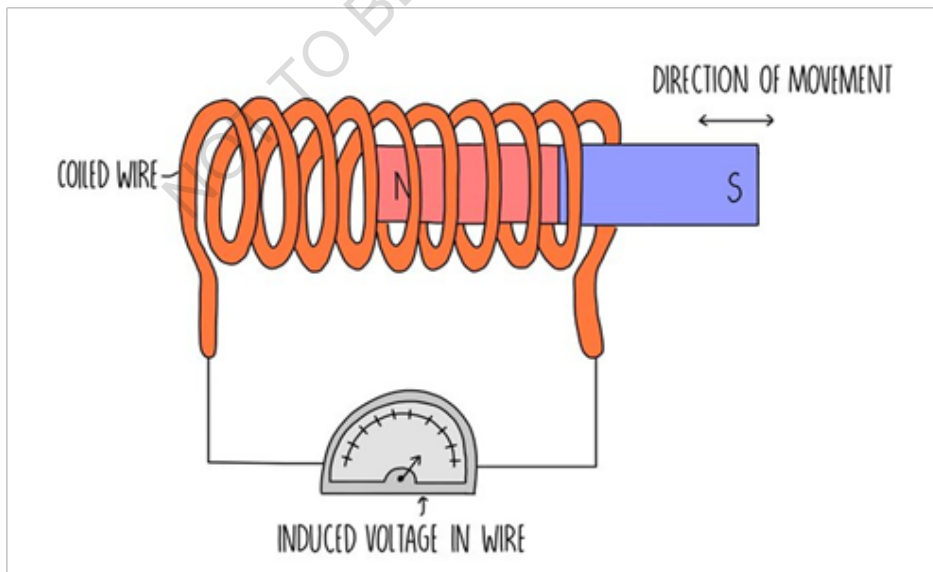


Fig 1.29 :Electromagnetic induction

Faraday's Laws:

First Law:

Whenever a conductor cuts magnetic flux an emf is induced in that conductor.

Second Law:

The induced emf is directly proportional to the rate of change of flux.

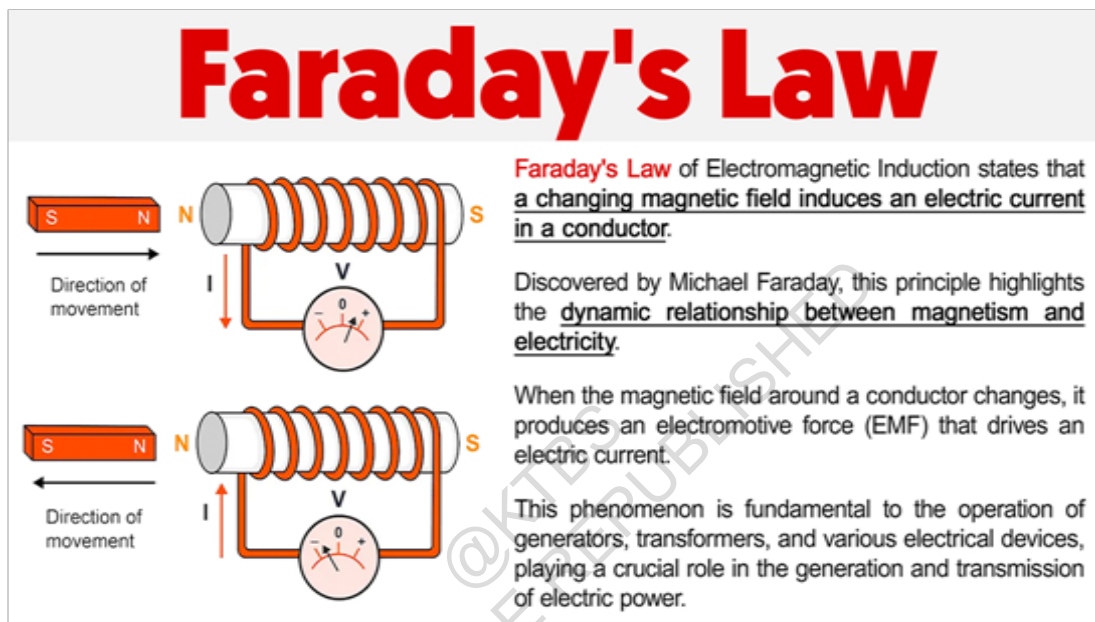


Fig 1.30: Faraday's law

Fleming's Left-Hand Rule and Right-Hand Rule:

Keep the fore finger, middle finger, and thumb of the left hand mutually perpendicular to one another.

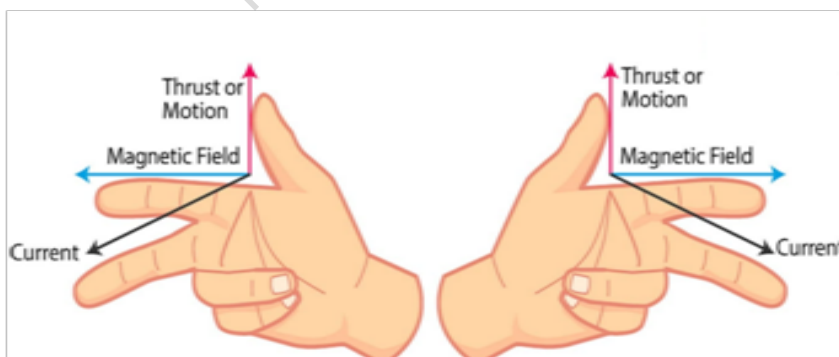


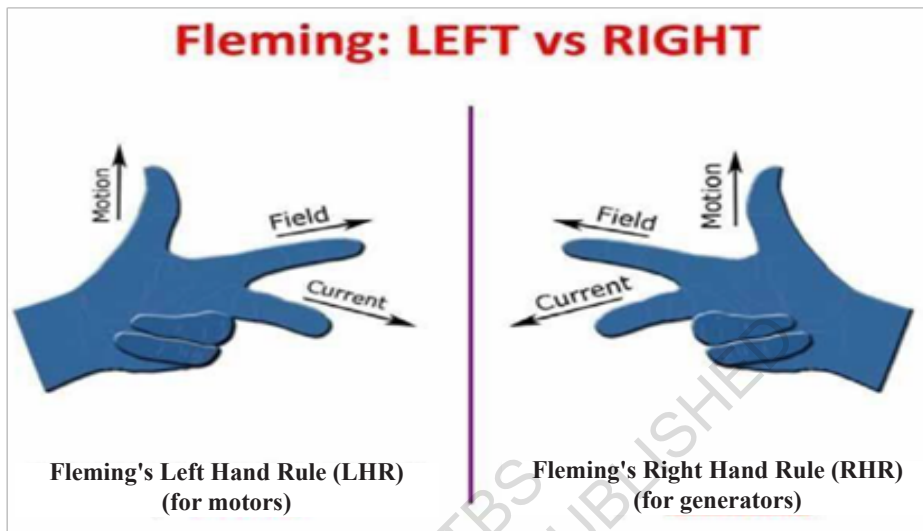
Fig 1.31: Fleming's left hand and right hand rule

The Fore Finger represents the Direction of Magnetic Field.

The Middle Finger represents the Direction of Current in the Conductor and

The Thumb represents the Direction of Motion of the Conductor.

Where is it used?



Lenz Law:

The direction of the induced current is such that it opposes the change in flux that has induced it.

$$E_b = -N \frac{d\Phi}{dt}$$

2.2 Winding

A conducting material wound or coiled about an object in order to produce Electro Magnetic flux is called winding. The two types of winding are

1. Wave Winding
2. Lap Winding

Lap Winding

In this case, if connection is started from conductor in slot 1 then connections overlap each other as winding proceeds, till starting point is reached again. Developed view of part of the armature

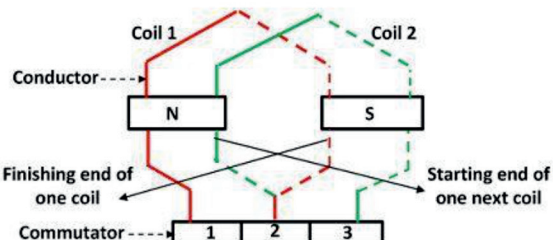


Fig 1.32: Lap winding

winding in lap fashion is shown in the Fig. 1.32. As seen from the Fig. 1.32, there is overlapping of coils while proceeding.

Key Point :

Due to such connection, the total number of conductors gets divided into 'P' number of parallel paths, where $P = \text{Number of poles in the machine}$. Large number of parallel paths indicate high current capacity of the machine hence lap winding is preferred for high current rating generators.

Types of Lap Winding :

1. Simplex Lap Winding
2. Duplex Lap Winding
3. Triplex Lap Winding

Simplex Lap Winding:

In simplex lap winding, the terminating end of one coil is joined to the commutator segment and the starting end of the next coil is placed under the same pole. Also, the number of parallel paths is like the number of poles of the windings as shown in the figure. 1.33.

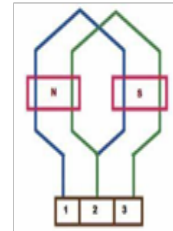


Fig 1.33: simplex lap winding

Duplex Lap Winding: In duplex lap winding the number of parallel paths between the poles is twice the number of poles. The duplex lap winding is mainly used for heavy current applications. Such type of winding is obtained by placing the two similar windings on the same armature and connecting the even number commutator bars to one winding and the odd number to the second winding as shown in the figure 1.34.

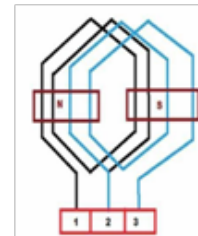


Fig 1.34 : Duplex Lap winding

Triplex Lap Winding :

In triplex lap winding the windings are connected to the one - third of the commutator bars. The lap winding has many paths and hence it is used for the larger current applications. The only disadvantage of the lap winding is that it requires many conductors which increase the cost of the winding.

Wave Winding -

In this type of connection, winding always travels ahead avoiding overlapping. It travels like a progressive wave hence called wave winding. To get an idea of wave winding a part of armature winding in wave fashion is shown in the Fig1.35.

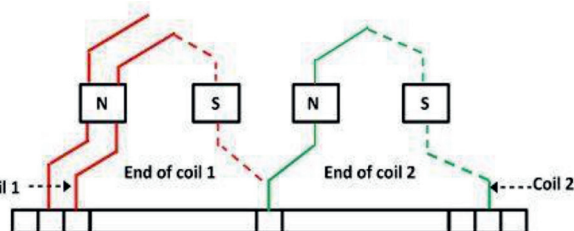


Fig 1.35 : Wave winding

Both coils starting from slot 1 and slot 2 are progressing in wave fashion

Key Point:

Due to this type of connection, the total number of conductors gets divided into two parallel paths always, irrespective of the number of poles of the machine. As the number of parallel paths is less, it is preferable for low current, high voltage capacity generators. The number of parallel paths in which armature conductors are divided due to lap or wave fashion of connection is denoted as A . So, $A = P$ for lap connection and $A = 2$ for wave connection.

Comparison of Lap and Wave Type Winding

Lap Winding	Wave Winding
1. Number of parallel paths (A) = poles (P)	1. Number of parallel paths (A) = 2
2. Number of brush sets required is equal to the number of poles.	2. Number of brush sets required is always equal to 2.
3. Preferred for high current, low voltage capacity generators.	3. Preferred for high voltage, low current capacity generators.
4. Normally used for generators of capacity more than 500A.	4. Normally used for generators of capacity less than 500A

2.3 Phase in electrical terms:

Distribution of alternating voltage to the electrical circuits is called phase. In general, phase is the electrical supply to the circuit.

Types of Phases: There are two types of phases. They are,

- Single Phase
- Three Phase

Single Phase Supply System:

Single phase requires the single wire to connect the circuit. The voltage of the single phase is 230V. The single - phase AC power supply is utilized for home appliances. The voltage of Single phase supply is 230V, 50 Hz.

Application of single-phase power supply:

Single phase supply is used for small electrical appliances and equipment, mostly for home applications.

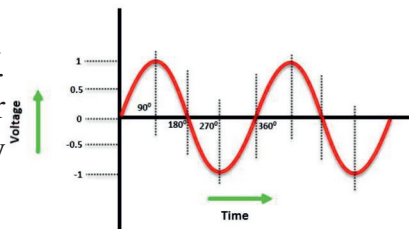


Fig1.36 : Single-phase power supply

Three Phase Supply System:

Three phase requires three wires to connect the circuit. The voltage of the three-phase supply is 415 V. Three phase power supply is used in huge industries to run heavy loads

Application of Three phases power supply:

Three phase supply is almost used for large electrical loads, mostly in motors.

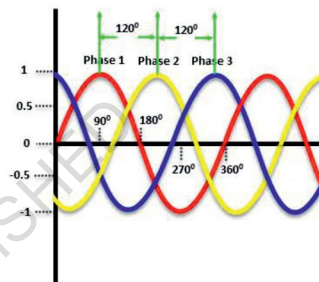


Fig 1.37: Three phase power supply

ACTIVITY 1

Role Play

Draw the magnetic field around a bar magnet.

Materials Required

A4 sheet, Pencil, Bar Magnet, Iron filings

Procedure

1. Form eight groups with at least 5 members in each.
2. Instructions given by the teacher to the students to draw the magnetic field around a bar magnet.
3. To visualize the magnetic field, place the bar magnet under an A4 sheet and lightly sprinkle the iron filings around the bar magnet. Tap the paper to see the iron filings align themselves showing the invisible magnetic field.
4. For reference click the video link or scan the QR Code
<https://www.youtube.com/watch?v=IJgzVaTPEow>



ACTIVITY 2

Role Play

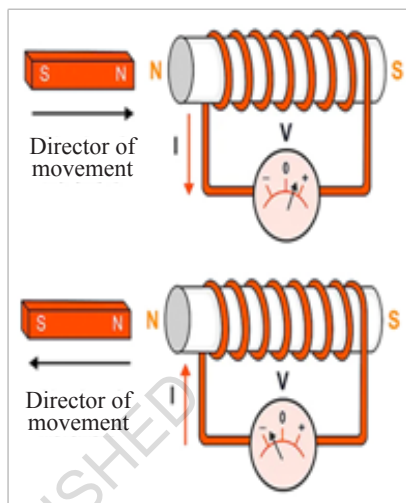
Demonstrate an experiment to show electromagnetic induction

Materials Required

Multimeter, Coil, Magnet

Procedure

1. Form eight groups with at least 5 members in each.
2. Instructions given by the teacher to the students to construct the circuit as shown in the given figure.
3. Measure the voltage using the multimeter and note down the readings. Also, note the magnet's direction of the movement.



ACTIVITY 3

Role Play

Demonstrate Fleming's Left and Right-hand rule

Materials Required

Hands of the student

Procedure

1. Students should demonstrate the rules using their own hands indicating the directions of motion/thrust, current, and magnetic field.

ACTIVITY 4

Role Play

Identify the type of winding present in the motor by dismantling it

Materials Required

Motor, Screwdriver Set, Rubber Mallet

Procedure

1. Form eight groups with at least 5 members in each.

-
2. Dismantle the motor.
 3. Instructions given by the teacher to the students to check for the number of poles and number of parallel paths.

CHECK YOUR PROGRESS

Fill in the blanks with suitable answers:

1. Single phase supply system requires _____ wires to connect to the circuit.
2. Three phase supply system requires _____ wires to connect to the circuit.
3. The voltage of the three phase supply system is _____ volts.
4. The voltage of the single phase supply system is _____ volts.
5. Fleming's right hand rule is applicable for _____.
6. Fleming's left hand rule is applicable for _____.

Answer the following questions:

1. What is phase?
2. State Faraday's laws.
3. What is electromagnetic induction?
4. State Fleming's right hand rule.
5. State Fleming's left hand rule.
6. State Lenz law
7. What is an electric field?
8. What is magnetic field?
9. Draw the diagram of electromagnetic induction.
10. Draw the diagram of duplex lap winding
11. Draw the diagram of simplex lap winding
12. Draw the diagram of wave winding.
13. Write the differences between single phase and three phase supply systems.
14. Write the differences between lap and wave winding.

Session 3: Introduction to Motor

Introduction to Motor:

Motor is an electromechanical device. It converts electrical energy into mechanical energy. It has a static part and a rotating part as shown in figure 1.38.

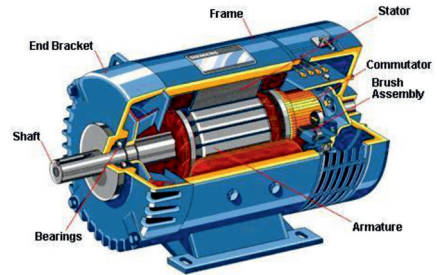


Fig 1.38: Cross section of motor

3.1 Parts of a Motor:

A motor consists of the following parts as shown in the figure 1.39 below.

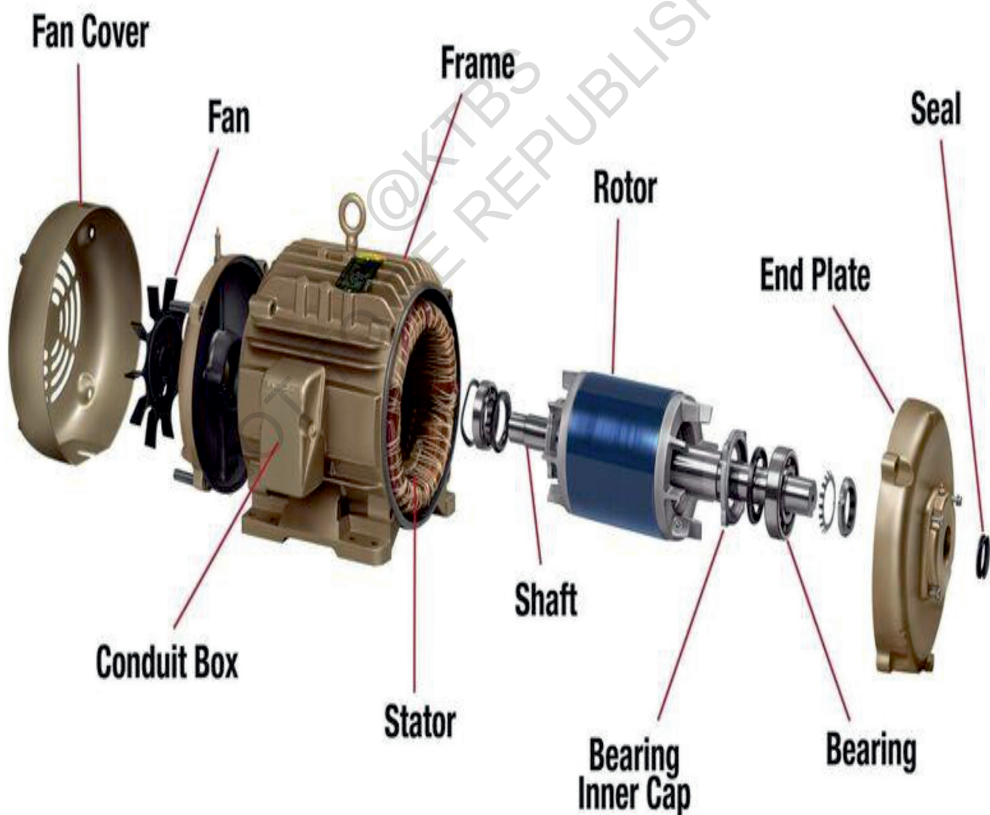


Fig 1.39 Parts of motor

1. Field Winding –

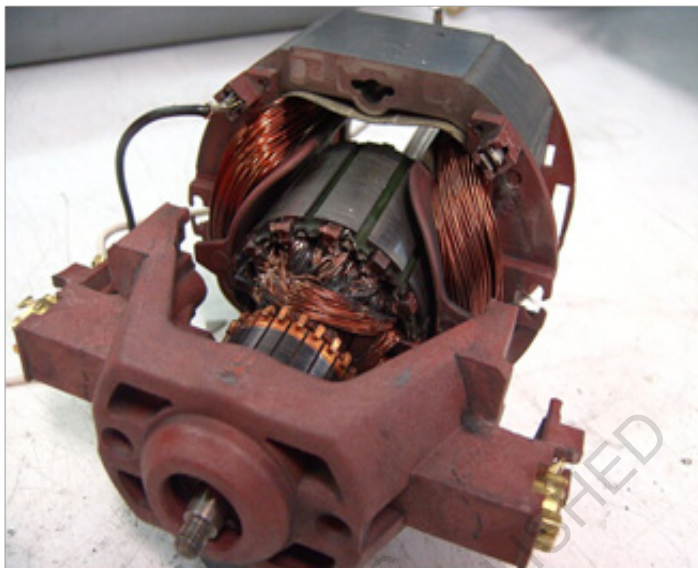


Fig 1.40 : Field winding

2. Armature Winding –

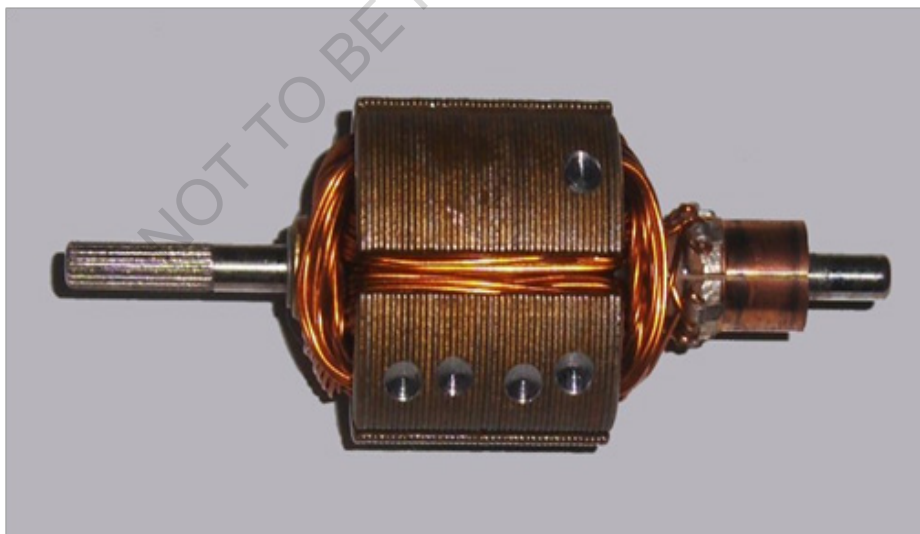


Fig 1.41: Armature winding

3. Yoke -

Yoke of the motor is made up of cast iron or steel. It is an integral part of the stator or the static part of the motor. Its main function is to form a protective covering over the sophisticated inner parts of the motor and provide support to the armature.

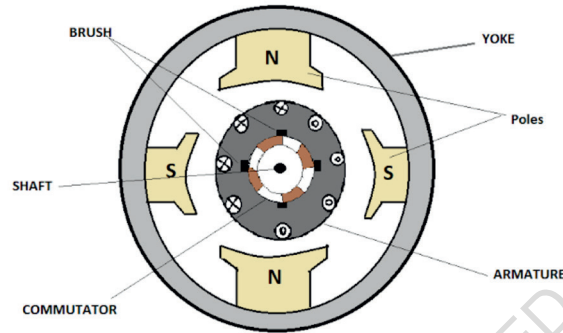
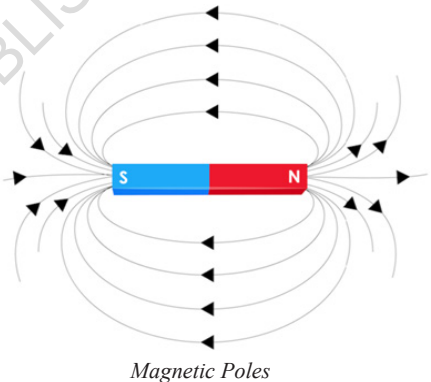


Fig 1.42: Yoke

4. Magnetic Poles - The north-seeking pole of a magnet is called a north magnetic pole. The south-seeking pole is called a south magnetic pole.



5. Field coils - A Field Coils is used to generate a magnetic field in an electro- magnetic machine, typically a rotating electrical machine such as a motor or generator. It consists of a coil of wire through which a current flows.



Fig 1.43: Field coils

6. Armature - The function of armature is to convert electrical energy (current) into mechanical energy (rotation) with the help of magnetic field.



Fig 1.44: Armature

7. Teeth - The teeth of the motor is used to produce and maintain sufficient torque.

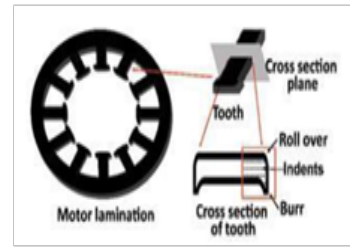


Fig 1.45 : Teeth

8. Slot-Slot insulation is the common name for shielding material used for the rotor inside a power generator. The slot insulation process for electric motors provides a barrier between the copper windings and the steel lamination for all stator, armature.



Fig 1.46: Slot

9. Brushes - A brush or carbon brush is a device which conducts current between stationary wires and moving parts, most commonly in a rotating shaft. Typical applications include electric motors, alternators, and electric generators.

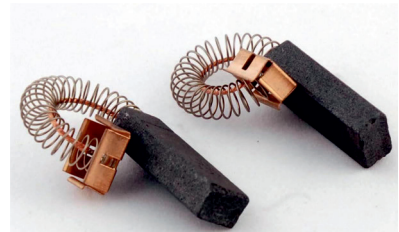


Fig 1.47: Brushes

10. Shaft - A shaft is a rotating machine element, usually circular in shape, which is used to transmit power from one part to another.



Fig 1.48: Shaft

3.2 Types of Motors:

There are two types of motors. They are

- DC motors
- AC motors

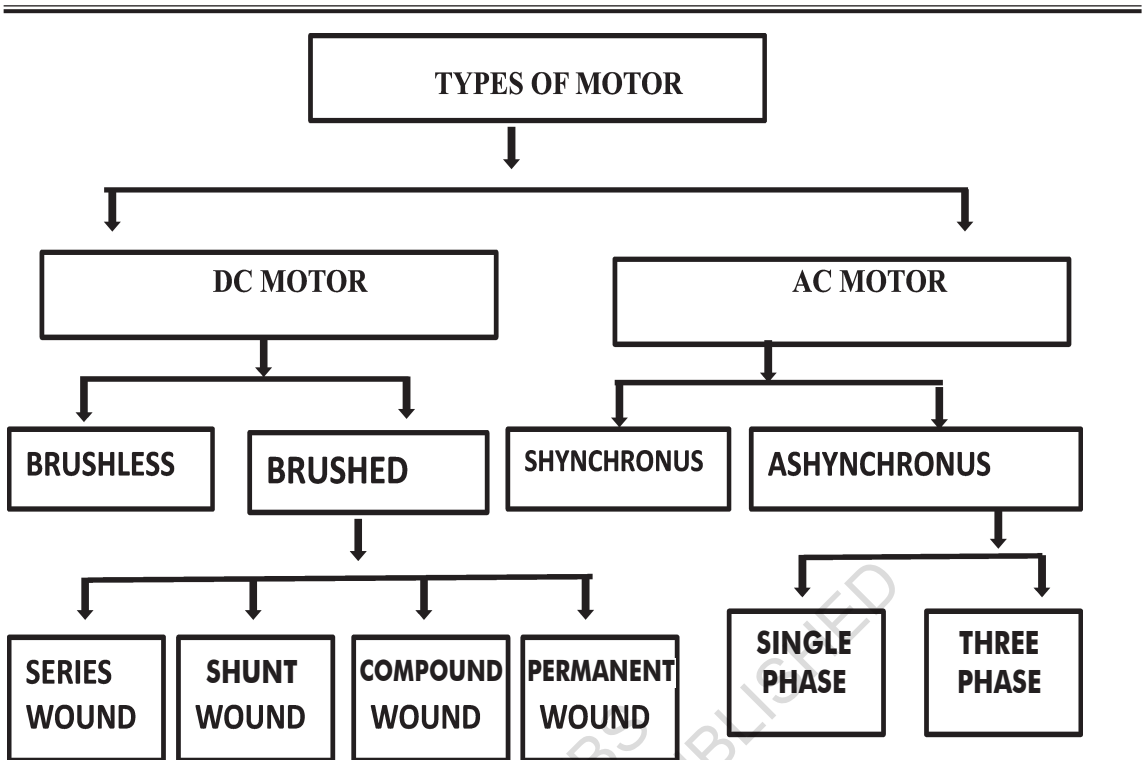


Fig 1.49 : Types of motors

AC Motors -Alternating Current Motors can be further classified into two types

- Synchronous AC Motors
- Asynchronous AC Motors – It can be subdivided into Single phase and three phase

DC Motors :

Direct Current Motors can be classified into Brush less and Brushed types.

Working Principle of Motor:

An electric motor is an electrical machine which converts electrical energy into mechanical energy. The basic working principle of a motor is: “whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force”.

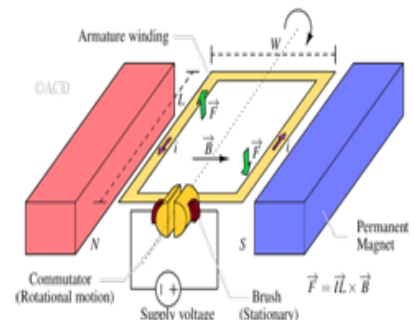


Fig 1.50: Working principle of a motor

The direction of this force is given by Fleming's left-hand rule and its magnitude is given by,

$$F = B \times I \times L \text{ Newton}$$

Here,

- F = Force
- B = Magnetic flux density
- I = Current
- L = Length of the Conductor

3.3 RPM of a Motor:

The rotation or revolution per minute of a motor is called the RPM of a motor.

Device used to measure the RPM of a motor:



Fig 1.51 Analog Tachometer



Fig 1.52: Digital Tachometer

Applications of AC Motor: AC motors have many applications, including:

- **Home appliances:** AC motors are used in refrigerators, washing machines, grinders, drills, and water pumps
- **Industrial applications:** AC motors are used in compressors, conveyor systems, fans, air conditioners, and transportation equipment
- **Electric cars:** AC motors are used in electric cars
- **Cameras:** AC motors are used in cameras for zoom and focus functions
- **Renewable energy:** Servo motors are used in solar tracking systems and wind turbines

AC motors are a good power source because they are simple, long-lasting, and require low power for start-up. They also reduce the risk of burnout, which can happen when a motor is overworked during start-up.

Applications of DC Motor: DC series motor is suitable for both high and low power drives, for fixed and variable speed electric drives. This type of motor has simple construction. Also, it is easy for design and maintenance. Due to its high starting torque, this motor is used in the low cost toys and automotive applications such as,

- Cranes
- Air compressor
- Lifts
- Elevators
- Winching system
- Electric traction
- Hair drier
- Vacuum cleaner and in speed regulation application
- Power tools
- Sewing machine
- Electric footing



ACTIVITY 1

Role Play

Identify the parts of a motor by dismantling it

Materials Required

Motor, Screwdriver Set, Spanner Set, Rubber Mallet

Procedure

1. Form eight groups with at least 5 members in each.
2. Dismantle the motor using the tools given.
3. Instructions given by the teacher to the students to identify and write the parts of the motor.

ACTIVITY 2

Role Play

Identify the different types of motor

Materials Required

Motor, A4 Sheet, Pen

Procedure

1. Form eight groups with at least 5 members in each.
2. Display different motors.
3. Instructions given by the teacher to the students to identify the types of motors on display.

ACTIVITY 3

Role Play

Read and list the specifications of a motor

Materials Required

Motor, A4 Sheet, Pen

Procedure

1. Form eight groups with at least 5 members in each.
2. Display different motors.
3. Instructions given by the teacher to the students to note down the specifications of the motor.

ACTIVITY 4

Role Play

Measure the RPM of a motor

Materials Required

Motor, Tachometer

Procedure

1. Form eight groups with at least 5 members in each.
2. Start the motor
3. Instructions given by the teacher to the students to measure the speed of the motor and note it down.

CHECK YOUR PROGRESS

Choose the correct answers

1. The device that converts electrical energy into mechanical energy is
a. Motor b. Generator c. Winding d. Inductor
2. Yoke is made up of
a. Cast iron b. Wood c. Semi conductors d. Glass
3. Device used to measure RPM of motor is
a. Ammeter b. Voltmeter
c. Clamp meter d. Tachometer
4. The part of the motor is used to produce and maintain sufficient torque is
a. Shaft b. Yoke c. Teeth d. Armature
5. The device which conducts current between stationary wires and moving parts is
a. Slot b. Field coil c. Brushes d. Shaft

Answer the following questions :

1. What is a motor?
2. List the parts of the motor.
3. Write the types of motor.
4. Write the working principle of motor.
5. Draw the diagram of the working principle of the motor.
6. Write the applications of AC motors.
7. Write the applications of DC motors.
8. Write the functions of
 - a) Teeth
 - b) Yoke
 - c) Field coil
 - d) Armature

-
- e) Slot
 - f) Brushes
 - g) Shaft

Can you do it!

1. Dismantle the cycle dynamo and explain about its parts.
2. Charge the mobile phone by using cycle dynamo.

Tips for vocational trainers

- Use magnets for explaining magnetic field
- Call a motor technician (Fitter) to explain the construction and working of motor
- Make a field visit nearer to an industry for knowing the applications of motors.

Reference links :

- https://www.youtube.com/watch?v=1_YfuH_AcxQ
- <https://www.youtube.com/watch?v=GSh0f94JwaA>
- <https://www.youtube.com/watch?v=BmwdSoGBIlg>
- https://www.youtube.com/watch?v=j_F4limaHYI

QR Code for the above video links :



Unit 2 – REPAIR AND MAINTENANCE OF MIXER, JUICER, & GRINDER



Learning outcomes

- 1) Understand the functioning of various components of Mixer, Juicer and grinder
- 2) Able to assemble and disassemble the Mixer, Juicer and Grinder
- 3) Able to replace the faulty components in mixer, Juicer and Grinder

Introduction

Home appliances are electrical machines which help in household functions, such as cooking, cleaning and food preservation. Home appliances can be divided into three classifications, which includes, small appliances, major appliances, and consumer electronics. Science inventions are making our life very faster and easier in all the fields. Particularly the inventions related to home appliances are very helpful to live better and to concentrate on other things. The invention of the mixer, grinder, washing machine, refrigerator radio and television are very useful and entertainable. In this chapter we are going to learn about the essential household appliances like mixer, juicer, and grinder. This will give a clear view to handle, maintain and repair the above said appliances.



Fig2.1: Home appliances



Fig 2.2 : Maintenance and repairing

Session 1:

Understanding the Features, Functions, Symptoms, and Identifications of Faults in different models of Mixer, Juicer & Grinder.

1.1 Mixer:

Mixer is a device used for crushing the food grains into small pieces or powder.

Working Process:

1. Place the Mixer on a clean and dry surface.
2. Keep away from heat and water.
3. Fix the jar properly.
4. Fix the top cover (lid) tightly.
5. Plug the mixer into a properly grounded (proper earthing) power socket and switch on the power.



Fig 2.3: mixer

Models of mixer:

• Single-phase blending

Mixing of liquids that are miscible or at least soluble in each other occurs commonly in process engineering (and in everyday life). An everyday example would be the adding of milk or cream into tea or coffee



Fig 2.4 : Single-phase blending

Solid Suspension:

Suspension of solids into a liquid is done to get better the rate of mass transfer between the solid and the liquid. Examples include dissolving a solid reactant into a solvent, or suspending catalyst particles in liquid to get better the flow of reactants and products to and from the particles



Fig 2.5 : Solid suspension

Static mixers:

Static mixers are used when a mixing container would be too large, too slow, or too expensive to use in each process.



Fig 2.6 : Static mixer

Liquid Whistles:

They are a type of static mixer which passes fluid at high pressure through an orifice and subsequently over a blade. This subjects the fluid to high turbulent stresses and may result in mixing, emulsification, deagglomeration and disinfection.



Fig 2.7 : Liquid whistle

1.2 Juicer:

A Juicer, also known as Juice extractor. It is a tool used to take out juice from fruits, herbs, leafy greens, and other types of vegetables in a process called juicing. It crushes, grinds, and squeezes the juice out of the pulp. Some types of juicers can as well function as a food processor. Most of the twin mechanism and horizontal masticating juicers have attachments for grave herbs and spices, extruding pasta, noodles, or bread sticks, making baby food and nut butter, grinding coffee, making nut milk, etc.



Fig 2.8: Juicer

Reamers:

Reamers are used for squeezing juice from citrus such as grapefruits, lemons, limes, and oranges. Juice is extracted by pressing or grinding a halved citrus along a juicer's ridged conical center and discarding the rind. Some reamers are stationary and require a user to press and turn the fruit, while others are electrical, automatically turn in the ridged center when fruit is pressed ahead.



Fig 2.9: Reamers

Centrifugal Juicers:

A centrifugal juicer cuts up the fruit or vegetable with a flat cutting blade. After that, make the spin at high speed to separate the juice from the pulp.



Fig 2.10: Centrifugal juicer

Masticating Juicers:

A masticating juicer known as cold press juicer or slow juicer uses a single auger to dense and crush make into smaller sections by squeezing out its juice beside a fixed screen while the pulp is barred throughout a separate outlet.



Fig 2.11: Masticating Juicers

Triturating Juicers:

Triturating juicers (twin gear juicers) have twin augers to crush and press produce.



Fig 2.12 : Triturating Juicers

Juicing press:

A juicing press, such as a fruit press or wine press, is a larger scale that is used in agricultural production. A mobile press has the advantage that it can be moved from one orchard to another. The process is primarily used for apples and involves a stack of apple mash, wrapped in fine interlock cloth, which is then pressed under approximately 40 tones. These machines are trendy in Europe and have been introduced to North America.



Fig 2.13 : Juicing press

Steam Juice Extractor:

A stovetop steam juice extractor is naturally a pot to generate steam that used to heat a batch of berries (or other fruit) in a perforated pot stacked on top of a juice collecting container that is above the steam pot. The juice is extracted lacking mechanical means so it is extremely clear and because of the steam heating it is also pasteurized for long term storage.



Fig 2.14 : Steam Juice Extractor

Wet Grinder: Wet grinders are used to make pastes from grains and rice, such as those used in cooking dosas and idlis.

Different Models:

Tilting model -

Tilting wet grinders are solid and utilize less space. In smaller houses, they are more preferred. These machines are designed with rolling stones which don't make high noise. With wet grinding capacities, they have dry grinding abilities too.



Fig 2.15 : Tilting model

Table-Top Model -

These wet grinders are portable, can be placed on top of a table because of its small size and are easy-to-maintain. They can be utilized for different types of grinding applications also.



Fig 2.16 : Table-Top Model

Features and Applications:

- Simple in construction.
- Lesser space.
- Food grains are powered based on our requirements.
- Easiest cleaning process.

Functioning of Various Electromechanical Parts of the Mixer/Grinder

Parts of Mixer:

By knowing the basic parts name and their functions of mixer, we can understand the basic operations of the appliance. This will be helpful to maintain the devices and to do repairs smoothly.

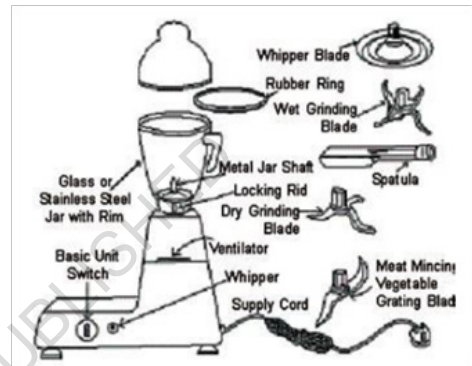


Fig 2.17 : Parts of Mixer

Parts of Wet Grinder

- Stainless steel drum
- Grinding stone
- Adjustable diverter
- Bearing
- Vertical stand
- Chain
- Grinder stone stand
- Belt
- Driven pulley
- Motor and Spin Plug
- Stain less steel drum

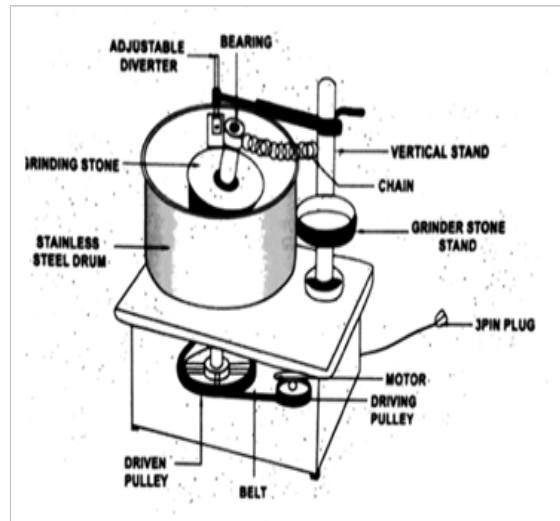


Fig 2.18: Parts of Wet Grinder

Frequently Occurring faults in Mixer:

In most cases of mixer jar jammed, the seal of the manner of the blender mixer blades leaks and the salty water from liquids of foods tend to leak into the bearings of the mixer blades, thus making it corroded and hence the jar is jammed. In such a situation, it would be unfeasible to use the appliance. One of the best solutions for this problem is keeping the jar upside down and wet some cooking oil into the space of the motor coupler.

The following faults are commonly occurring in mixer,

1. Sudden stopping, while grinding.
2. Sudden unwanted noise, during grinding.
3. Jar blade doesn't rotate while the mixer is running.
4. Mixer is not in working condition.
5. Spark and burning smell come from the mixer.
6. Delay in grinding.
7. Abnormal speed of motor.

PRACTICAL

Practical 1 -Demonstrate the usage of mixer/grinder.

Write the step-by-step procedure for handling mixer/grinder.

1. As the mixer grinder is used frequently for mixing dry and wet ingredients between other things, cleaning it after every use is very important. Always wash the jars carefully in water and dry them. This will help in receiving free of odour that occurs after every use. Do not remember to take out the blades before you start cleaning.
2. Always lock the jar suitably before each use to keep away from damage to the blades.
3. Make sure that the speed goes from low to high instead of starting it at full speed in the starting. This ensures compact pressure on the motor.
4. Check whether the ingredients are at room temperature before grinding. Really hot food may spoil the product.
5. To keep away from spilling, ensure the cover is secured well during the grinding process.

-
6. Clean the cord with a wet cloth to get free of moisture completely.
 7. Make sure that the mixer grinder is stored in a protected location and nothing falls on it that might cause spoil. Keep it out of reach of children as far as possible.
 8. To keep away from electric shock, avoid running the mixer close to places where there is water around.

Practical 2 - Demonstrate to diagnose the faults on initial inspection

1. Check whether the supply is available in the outlet
2. Check if the power cord is in good condition or not.
3. Check the overload switch is in which condition.
4. Check the speed switch in “0” position.
5. Check whether the mixer’s Jar, coupler, have any physical damages and also for grinder.

Practical 3 -Perform basic tests

Materials required:

1. Mixer
2. Tester
3. Multi meter
4. Test lamp

Test 1: Power supply test

1. Disconnect the mixer’s power cord from the supply
2. By using a tester / test lamp, test the main supply.

Test 2: Volt ampere test

By using multimeter

1. Check the proper voltage and current coming from the supply.

Test 3: Earth test

By using test lamp

1. Check the insulation between winding and body of the motor

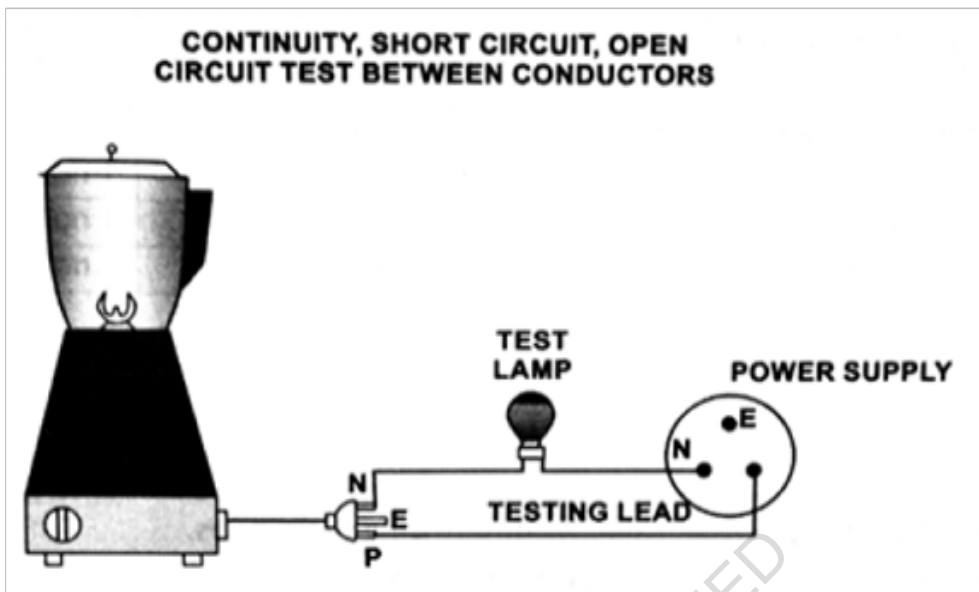


Fig 2.19

Practical 4 -Demonstrate to separate and inspect every module of the unit

- Different Models of appliances (mixer/juicer/grinder), their features and functioning.
- Functioning of various electromechanical parts of the mixer/grinder.
- Frequently occurring faults such as abnormal noise during grinding.
- Components/modules of different mixers/juicers/grinder.
- Other products of the company.
- Reassembly process of the mixer/juicer/grinder.
- Factors confirming the proper functioning of the repaired/replaced part or unit of the mixer/juicer/grinder.
- Cleaning and maintenance process of mixer/juicer/grinder.

Practical 5 - Perform in depth diagnosis in the service Centre.

1. Check the availability of supply by tester (or) test lamp.
2. Check the overload switch is in the correct position.
3. Check whether the coupler is free to rotate or not
4. While running, is the movement free or forced

-
5. Delay in grinding.
 6. Abnormal speed of motor.

CHECK YOUR PROGRESS

Choose the correct answers

1. Mixer is used for
 - a. Freezing food
 - b. Grinding food
 - c. Heating food
 - d. Cooling food
2. Masticating juicer is also known as
 - a. Juicing press
 - b. Twin gear
 - c. Cold press
 - e. Wine press
3. A type of a juicer used to squeeze juice from citrus fruits is
 - a. Reamer
 - b. Centrifugal juicer
 - c. Masticating juicer
 - d. Juicing press
4. Which of the following is NOT a model of mixer
 - a. Solid suspension
 - b. Single phase blending
 - b. Static mixer
 - d. Table top
5. Which of the following is NOT a part of wet grinder
 - a. Belt
 - b. Blades
 - c. Driving pulley
 - d. Driven pulley

match the following :

Sl no	Column-A	Column-B
1	Reamer	Cold press
2	Masticating juicer	Wine press
3	Triturating juicer	Manual styled juicer
4	Juicing press	Twin gear

Answer the following:

1. What is juicer?
2. What is a mixer?
3. What is a wet grinder?
4. List the models of the mixer.

-
5. List the models of juicer.
 6. List the models of wet grinder.
 7. Write the working process of the mixer.
 8. List the applications of wet grinder.
 9. List the parts of the wet grinder.
 10. List the parts of mixer
 11. Write the frequently faults in mixer
 12. Write the step by step procedure for handling mixer/grinder.
 13. Write the steps to perform an in-depth diagnosis in the service centre

Session 2 :

Replace Dysfunctional Module in Mixer / Juicer / Grinder - Components / models of different Mixer / Juicer / Grinder

Universal Motor:

Same way, in a universal motor, both windings are connected in series with each other. When the motor is supplied from an AC or DC voltage source, magnetic fields are developed in both armature and field winding. They react on each other to produce a unidirectional torque.



Fig2.20: Universal motor

OLR Switch - An overload switch in a mixer grinder is a safety feature that automatically cuts off the motor when it detects an overload:

- **Purpose:** Prevents the motor from damage due to overheating or excessive load.
- **When it's useful:** When grinding tough ingredients or using the mixer grinder for an extended period.
- **How it works:** Cuts off the power supply when the current exceeds the rated amperage.



Fig 2.21:OLR Switch

Speed Setting Switch:

Speed Setting Switch: Monitoring Speed is important in any automation method. Speed of any equipment is determined by an electric motor and can vary due to a variety of reasons e.g., overload, under load, crack of transmission parts etc. In case of open loop control, a speed monitoring device is useful to either give an alarm or to switch off the motor. In case of a closed loop control, e.g., D.C. drive or V/F drive, feedback is required to take remedial action.



Fig2.22:Speed Setting Switch

Jars:



Fig2.23:Jars

In most cases of mixer jar jammed, the sealing manner of the blender mixer blades leaks and the salty water from liquids of foods tends to leak into the bearings of the mixer blades, thus making it corroded and hence the jar jammed. In such a situation, it would be unfeasible to use the appliance. One of the best solutions for this problem is keeping the jar upside down and wet some cooking oil into the space of the motor coupler.

Blades:

The blade component in the blender is a function for crushing and mixing the ingredient with a very fast rotating speed. First, we need to understand the structure of the blade to enable the blade to perform the process like slicing and mincing. We know blades need to be fixed under high rotational speed operation, therefore the blade must have the high modulus of rigidity to prevent any bend during the operation.

It is because the shearing force acts on the blade is very high due to its speed. Since it is rotating at high speed when the food is being put into the food container, it will cause an impact on the blade that will cause the blade to break or crack if the blade is not tough enough. Blenders are blade grinders designed specifically for use with wet ingredients. Blenders are popular tools for manufacturing of purees and pastes, using both the cutting and shearing effects of high-speed blades.



Different types of blades

Supply Cord (or) Power Cable:

A power cord is an electrical cable that temporarily connects an appliance to the mains electricity provided via a wall socket or extension cord. A power cable is an electrical cable, a gathering of one or more electrical



Fig2.24 : Power cord

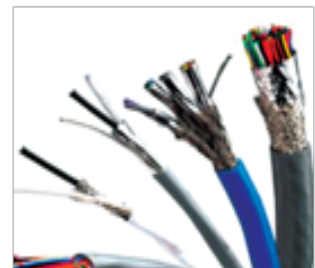


Fig2.25 : Power cable

conductors, usually supposed collectively with an overall covering. The gathering is used for transmission of electrical power. Power cables may be installed as stable wiring within buildings, hidden in the ground, run transparency, or uncovered.

Power Indicator:

Power indicators usually need to carry a wave current and support a high peak current without saturating. With switch mode power supply frequencies moving increasing every year, the demands on inductors are starting to outpace conventional wire wound technologies. Power indicators are used to indicate the power availability in the electrical device



Fig 2.26: Power indicators

Armature:

An Armature is the power-producing element of an electric machine. The armature can be on either the rotor (rotating part) or the stator (stationary part) of the electric machine. The armature interacts with the magnetic field (magnetic flux) in the air-gap; the field element can include either permanent magnets, or electromagnets produced by a conducting coil, such as another armature (i.e., doubly-fed electric machine). The armature must carry current, so it is always a conductor or a conductive coil, oriented normally to both the field and to the direction of movement, torque (rotating machine), or force (linear machine).

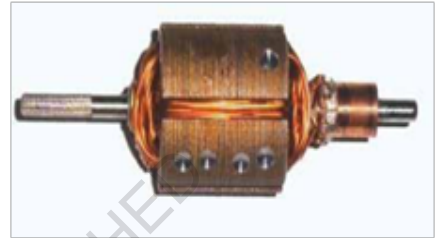


Fig2.27 : Armature

Coupler:

A mixer grinder coupler is a small, circular device with teeth that sits on top of the motor of a mixer grinder. The mixer jar is placed on top of the coupler, and the teeth on the jar coupler mesh with the teeth on the motor coupler. The coupler ensures that power is smoothly transmitted from the motor to the mixing attachments. Here are some things to consider about mixer grinder couplers:



- **Compatibility:** Some couplers are compatible with a wide range of mixer grinder brands, including Preethi, Bajaj, Crompton, Lifelong, Murphy Richard, Usha, Pigeon, Sumeet, and Orient. However, they may not be suitable for juicers or Sujata.
- **Material:** Couplers can be made from durable plastic or high-quality nylon.

- **Fit:** Some couplers are designed to fit snugly under specific jars.
- **Easy of replacement:** Some couplers are easy to replace.

Summary of Mixer Parts and Functions:

Sl.	Part	Function
1	Supply cord (or) power cable	It carries electrical power to mixer from the supply
2	Power indicator	It indicates the power availability of mixer
3	Speed setting switch	It used to vary the speed of mixer
4	Field and armature assembly	Motor – gives rotating movement to the jar
5	Coupler	It couples and transfers rotating movement to the jar
6	Overload switch	It is used cut off the supply automatically when mixer gets overloaded
7	Jar	It's a vessel which contains a blade to grind the food
8	Blades	It is used to grind various food items.

Components of Juicer:

1. Motor -

Motor the machine which makes the other juicer parts move to perform their functions. It is powered by electricity to create mechanical movements.

2. Base housing -

Base housing provides the body of the juicer. This conceals the motor to make it safer to use the appliance.

3. On/off switch -

On/off switch turns juicer on and off. Some juicers have controllers with speed numbers (like in most blenders and electric fans) where you can choose how fast you would like the juicing disc to rotate.

4. Power cord -

Power cord connects the juicer to a power outlet.

5. Juice container -

Juice container this is where the juice – the finished product – would go, ready for drinking. Usually made of glass or transparent plastic materials.

PRACTICALS

Practical 1 -

Demonstrate to replace the damaged power cord of mixer /grinder.

Materials required:

1. Screw driver
2. Multimeter
3. Tester

Procedure:

1. Disconnect the power cord from the supply.
2. Check the continuity of the power cord by using a multimeter.
3. Change the power cord if there is no continuity.

Practical 2 -

Demonstrate to remove and replace the faulty OLR

1. Check the OLR switch position.
2. If position changes, change its position.
3. Join the two wires of the OLR switch while the mixer grinder is running, replace the OLR switch.

CHECK YOUR PROGRESS

Match the following

Sl no	Column A	Column-B
1	Supply cord (or) power cable	It is used to grind various food items.
2	Power indicator	It is used cut off the supply automatically
3	Coupler	It indicates the availability of Mixer
4	Overload switch	It carries electrical power to mixer from the supply
5	Blades	It couples and transfers rotating movement to the jar

Answer the following:

1. Write the function of the coupler in a mixer.
2. Write the function of blades in a mixer.
3. Write the function of the OLR switch in a mixer.
4. List the components of the juicer.
5. List the components of the mixer.

Session 3:

Reassembly process of the mixer/juicer/grinder

Wet Grinder:

Wet grinders are used to make pastes from grains and rice, such as those used in cooking dosas and idlis. Wet grinding is rare in western cuisine but ordinary in Indian cuisine. These grinders usually consist of a small number of granite stone plates that are rolled against another stone plate with the items to be ground among them. Wet grinders have two advantages over electric mixers or blenders. First, the stone grinder generates less heat than a mixer. Heat affects the taste of the food. Second, the stones stay pointed for a greater time than do metal blades. A wet grinder can also refer to a tool for abrasive cutting of hard materials, or a food

preparation appliance used particularly in Indian cuisine for grinding food grains to make a paste or batter. A wet grinder for abrasive grinding uses liquid for cooling, whereas one for food preparation uses water to mix with ground grain to produce batter.

1. These grinders generally consist of a few granite stone plates that are rolled against another stone plate with rice or grains.
2. Wet grinder works on electricity with the principle of reducing manual work. The base grinding stone is driven by an electric motor.
3. Upper grinding stone is held by a chain. At first the grinding material is kept between the two stones.
4. While the rotating process starts the food material gets grinded.

Confirm Functionality of the Repaired unit:

Reassembly Process of the Mixer/Grinder:

1. Clean the dust by using blowers.
2. Connect the OLR switch in the base.
3. Fit the universal motor in its position.
4. Connect the speed switch in its appropriate position.
5. Tight all the screws inside the mixer.
6. Fix the top cover with the base.
7. Connect the coupler with the shaft.
8. After checking all the connections made correct, switch on the supply, and make a test run.

Factors confirming the proper functioning of the repaired/replaced part or unit of the mixer/ juicer/grinder:

To solve mixer grinder related problems, you must know which the most common ones are. The following are the most common mixer grinder problems and their repair methods

1. Leaking mixer grinder -

Leaking proves to be one of the most ordinary mixer grinder problems. To correct it, you first need to check the blade gathering and ensure that it is tightly screwed onto the jar. Another reason for a leaking mixer could be a problem with

the rubber gasket. You can replace it easily by purchasing it from a local hardware store. Leaking can also result due to a crack in the jar and in this case you may need to replace the jar altogether.

2. Stuck buttons of the mixer grinder -

Another one of the ordinary mixer grinder problems is stuck buttons. This generally happens when foods and liquids leak a little bit and enter the space among the buttons. To correct this issue, you must unplug the appliance and give it a nice careful cleaning. Some models have the alternative of removing the face of the buttons and in this case, you can easily clean the button spaces to take out liquids and food particles. Take an old toothbrush for an enhanced cleaning.

3. Slow moving blades -

Out of the many ordinary mixer grinder problems, one is slow moving blades. This can prove grating because in this case the foods and liquids take a long time to get mixed or churned. In most of the cases, this problem is caused due to food particles bottlenecking the blade gathering. There is a very easy solution for this. You must disassemble the blade assembly and soak the parts in soapy water which is slightly warmed for another half an hour. Scrub the parts properly and reassemble them all. Try turning on the mixer grinder and press the 'ON' button to see whether the blades turn faster now.

Cleaning and Maintenance process of mixer/juicer/grinder:

1. Overloading of wet-grinder should be avoided to prevent overheating of the motor.
2. It should not be used in a low-voltage situation. Low- voltage may cause the motor to run slowly and eventually overheat it.
3. It should be thoroughly cleaned and dried after use to prevent bad odour. The equipment should be covered when not in use.
4. The equipment should be used according to the manufacturer's Guidelines.

Cleaning Of Juicer:

1. Switch off the power and unplug the juicer.
2. Open the drum lid by turning it in an anticlockwise direction.
3. Lift the juicer bowl off the base by turning it in an anti-clockwise direction.
4. Separate the bowl from the set of rotation wiper, strainer, and juicing screw.

-
5. Reassemble the juicing screw and strainer from the rotation wiper.
 6. Wash the pots in running water.
 7. Clean the holes of the strainer with a brush and mild soap solution.
 8. Swipe the base with a soft damp cloth.
 9. Clean all metal parts thoroughly.
 10. Let all the parts dry completely before storing.

Cleaning Of Mixer/Grinder:

All the parts of a mixer/grinder such as jars, blades, and the base unit should be cleaned thoroughly after every use.

Cleaning the Jar:

1. Pour mild soak water into the jar.
2. Place the jar on the base and run for some time.
3. Run the jar for 2 – 3 seconds.
4. Remove and wash the inside of the jar with water.
5. Keep the jar inverted to dry.

Cleaning the base unit:

1. Unplug the unit.
2. Separate it from the jar.
3. Clean thoroughly with a soft, damp cloth.
4. Do not immerse the unit in water.

Cleaning the blades:

1. Turn the jar upside down.
2. Loosen the threaded bottom disc by turning it anti-clockwise.
3. Remove the disc, sealing ring and blade.
4. Clean the blade under running water.
5. Let the blade dry completely before storing.

PRACTICAL

Practical 1 -

Demonstrate to reassemble the mixer/juicer/grinder.

1. Clean the dust by using blowers.
2. Connect the OLR switch in the base.
3. Fit the universal motor in its position.
4. Connect the speed switch in its appropriate position.
5. Tight all the screws inside the mixer.
6. Fix the top cover with the base.
7. Connect the coupler with the shaft.
8. After checking all the connections made correct, give the supply, and make a test run.

Practical 2 -

Demonstrate and confirm functionalities of the repaired mixer/ juicer/grinder.

1. Leaking mixer grinder
2. Stuck buttons of the mixer grinder
3. Slow moving blades

Practical 3 -

Demonstrate the cleaning procedures of mixer/juicer/grinder.

All the parts of a mixer/grinder such as jars, blades, and the base unit should be cleaned thoroughly after every use.

Cleaning the Jar:

1. Pour mild soak water into the jar.
2. Place the jar on the base and run for some time.
3. Run the jar for 2 – 3 seconds.
4. Remove and wash the inside of the jar with water.
5. Keep the jar inverted to dry.

Cleaning the base unit:

1. Unplug the unit.
2. Separate it from the jar.
3. Clean thoroughly with a soft, damp cloth.
4. Do not immerse the unit in water.

Cleaning the blades:

1. Turn the jar upside down.
2. Loosen the threaded bottom disc by turning it anti-clockwise.
3. Remove the disc, sealing ring and blade.
4. Clean the blade under running water.
5. Let the blade dry completely before storing.

CHECK YOUR PROGRESS

Answer the following:

1. Write the reassembly process of mixer/wet grinder.
2. Write a short note on the wet grinder.
3. Write the factors confirming the proper functioning of the repaired/replaced part or unit of the mixer/ juicer/grinder
4. Write the cleaning and Maintenance process of mixer/juicer/grinder.
5. Write the cleaning process of the jar.
6. Write the cleaning process of blades.
7. Write the cleaning process of the base unit.

Can You Do it!

1. Collect the various images of the mixer/grinder.
2. Collect the fruits and make two fruit juices.

Tips for Vocation Trainer

1. Make a call to field technician for demo on the working of mixer/juicer/grinder
2. Arrange a field visit to take your students to nearby electronics home appliances enterprises.

Reference links

1. <https://www.youtube.com/watch?v=tGWgMqnOvag>
2. <https://www.youtube.com/watch?v=XXDNpG7Dqfc>
3. <https://www.youtube.com/watch?v=Omk3qcm1Xpg>



QR Code for the above video links:

Unit 3



REPAIR AND MAINTENANCE OF MICROWAVE OVEN

Learning outcomes

- 1) Understand the functioning of various components of microwave oven
- 2) Able to troubleshoot the system
- 3) Able to replace the faulty components in microwave oven

Introduction:

Microwave oven is a home appliance which is used in the kitchen in order to heat and cook the food. The food in the microwave oven is heated by the microwave which is generated by the magnetron that is built inside the microwave oven. Microwave is a type of electromagnetic wave. Microwave ovens were invented by Percy spencer.

Session1:

Understand Symptoms and Identify Fault

This Section describes the symptoms to understand the functionalities of Microwave oven and identify the fault. Microwave oven has become one of the essential appliances that are used in the kitchen. They are also used to reheat the food, grill, or even bake warm beverages to make soup, coffee, or tea and to make instant snacks like popcorn etc. as shown in the figure 3.1. No other cooking appliance makes it as easy as a microwave oven. It suits our rushed lifestyle.



Fig 3.1 : Microwave oven

Did you know ?

The first ever microwave oven that was produced was approximately 6 feet tall and its weight was over 750 pounds.

Different Models of Microwave Ovens, their features, and functionalities:

Some of the commonly used models of microwave ovens are as follow

- Solo Microwave oven
- Grill Microwave oven
- Conventional Microwave oven.

Solo Microwave Oven:

Solo Microwave ovens can be only used for cooking and reheating. Compared to Grill and Convection microwave ovens the cost of the Solo Microwave ovens is less. The microwaves in this type are produced by a single magnetron. Solo Models are the basic model of the microwave oven. This type of microwave ovens cannot be used to grill, roast, and bake the food as shown in the figure 3.2.



Fig 3.2 : Solo Microwave Oven

Grill Microwave Oven:

Grill microwave ovens are provided with additional heating coil that produces grilling, toasting, and roasting process. In this type of microwave oven cooking and grilling process can be done simultaneously. During the process of grilling a brown layer is created on the surface of the food as shown in the figure 3.3.



Fig 3.3 : Grill Microwave Oven

Convection Microwave Oven:

The conventional microwave oven consists of a coil for grilling and has a heater with a fan. The heat waves that are generated are spread around the food so that the food can be cooked quickly and can be used to bake the food as shown in the figure 3.4. In this type of microwave oven both the process of grilling and cooking can be done either separately or simultaneously depending upon the requirements.



Fig 3.4 : Convection Microwave Oven

Some of the common features and functionalities of Microwave Oven:

The microwave Oven consists of a control panel which includes the following features, Liquid Crystal Display (LCD), Light Emitting Diode (LED) or Vacuum Fluorescent Display (VFD) in a Microwave oven is used to monitor the cooking process which is based on the selection of function. Numeric buttons in a microwave oven are used to set the cooking time for a food to be cooked as shown in figure 3.5. Power level selection in a microwave is used to set the amount of heat to be dissipated based on the nature and quantity of food to be cooked. Start Button is used to turn on the microwave oven

Note: The start button will not work when the child lock mode is ON. Select/ Auto Cook setting– when it is turned ON, the microwave oven consists of a sensor that senses the steam in the food that needs to be cooked and automatically sets the power level and cooking time.



Fig 3.5: Microwave control panel

Functioning of Microwave oven and its various modules:

Functioning of microwave oven:

The microwave oven consists of a magnetron and a wave guide. When the power is supplied to the magnetron, the magnetron converts the electricity into high powered 12cm (4.7inch) radio waves. These waves that are produced by the magnetron are passed through the channel called wave guide. Whenever the food is placed on the turntable and the timer is switched on, a signal is sent to the magnetron and the magnetron starts to generate and passes the microwaves as shown in the above figure 3.6.

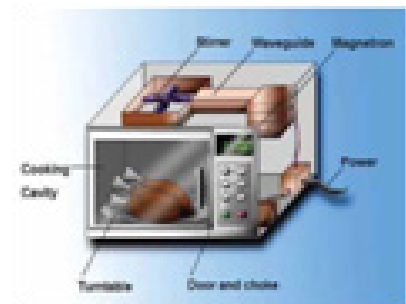


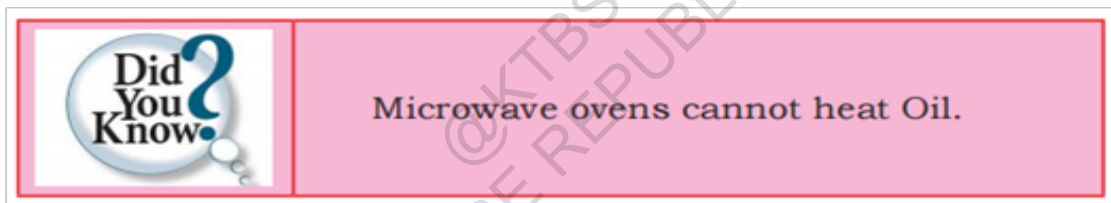
Fig 3.6 :Components of microwave oven

The food particle which is kept in the chamber attracts the microwaves from the waveguide. So that the water molecules in the food particle starts to vibrate against each other at a very high speed, due to this rapid vibration of the water molecule heat is generated. Hence, whenever the microwaves provide energy to the food particle kept inside the chamber of the microwave oven, the molecules in the food particle vibrates at high speed that leads to the generation of heat. Microwave ovens heats food inside out by heating the molecules.

Various modules of microwave oven:

A Microwave consists of five modules namely,

1. Power Supply
2. Microwave Generation
3. Cooking Cavity
4. Control Panel
5. Electromechanical Components.



Power Supply:

The power supply unit in a microwave oven consists of three parts namely,

1. High Voltage Transformer
2. High Voltage Capacitor
3. High Voltage Diode

High Voltage Transformer -

High voltage transformer plays a major role in microwave ovens. It supplies enough energy to the magnetron to generate the microwaves and it also drives the filament for the magnetron as shown in figure.



High voltage transformer

High Voltage Capacitor -

High voltage capacitor is connected to the transformer, magnetron, and via the diode. It charges and discharges when required and delivers high energy to the magnetron as shown in figure 3.7.



Fig 3.7 :High voltage capacitor

High Voltage Diode -

High voltage diode in the microwave oven is used for protection purposes. In order to withstand the high voltage in the microwave Circuit as shown in figure 3.8.



Fig 3.8:High Voltage Diode

Microwave Generation:

Magnetron -

Magnetron consists of a filament. When the transformer supplies high voltage to the magnetron, the filament of the magnetron gets heated up and it emits the electrons. The filament is surrounded by a positive terminal called Anode which is placed between two ring magnets, one at the top and another at the bottom. Usually the opposite charges attract each other, so the electrons move towards the anode but due to the presence of the ring magnets the electrons move towards the anode in a spiral path. Whenever these electrons pass through the cavity of the anode it generates the Microwaves. In simple terms the magnetron converts the electrical energy from the transformer into Microwaves as shown in

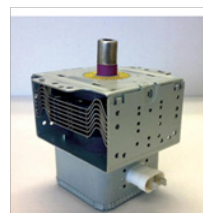


Fig 3.9 :Magnetron

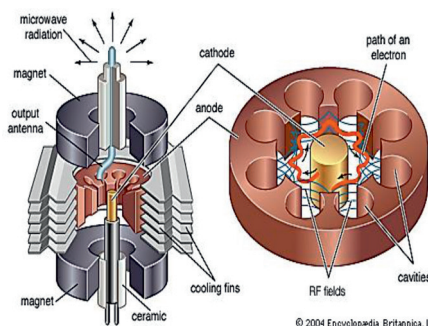


Fig 3.10 :Parts of magnetron

the above figure 3.9. The frequency of the microwaves that are generated by the magnetron in the microwave oven is 2.4GHz

Waveguide -

The function of the wave guide is to direct the microwaves generated by the magnetron to the cooking chamber of the microwave oven and it also controls the direction of the microwaves in the cooking chamber. It is done through narrowing the space of microwaves generated from the magnetron as shown in the figure 3.11.



Fig 3.11 :Waveguide

Cooking Cavity -

The cooking cavity of the microwave oven includes three parts as follows,

1. Cooking Chamber
2. Cavity Lamp
3. Turntable Motor

Cooking Chamber - Cooking chamber in a microwave oven keeps the output radiation within the limit due to which the food gets heated.

Cavity Lamp - Cavity lamp is present in a microwave oven in order to show the progress of the food that is being cooked in the microwave oven.

Turntable Motor - Turntable motor in a microwave oven rotates the food so that the heat is evenly spread.

Function of Various Electromechanical Parts of the Microwave Oven:

It consists of five parts namely,

- Stirrer Fan
- Blower Fan
- Grill
- Interlocks
- Turntable motor (is also an electromechanical part).

Stirrer Fan -

In order to spread the microwaves uniformly inside the microwave oven stirrer fans are used. Stirrer fans are fixed on the top of the cavity as shown in the figure 3.12.



Fig 3.12: Stirrer fan blade

Blower Fan -blower fan in a microwave oven is used to maintain the temperature of the magnetron by exhausting the hot air.

Grill -

It is used for grilling the food placed inside the microwave oven. When the microwave Oven is set in grill mode, it reduces the cooking time of the food by preheating the microwave oven before the food to be cooked is placed inside the oven.

Interlocks -

In case if any of the two or three locks of the microwave ovens are not properly locked then the Interlocks stop the working of the microwave oven.

Trouble shooting method with respect to microwave oven

Sl.	Problem	Cause
1	No response after pressing stop / clear button	1. Defect in Primary interlock relay(or) door sensing switch 2. Control Unit 3. Key Unit
2	Oven lamp doesn't light at all	1. Short (or) open wiring 2. Defect in Oven lamp (or) socket
3	Oven is working but food is not getting heated up	1. Short (or) open wiring 2. Fault in Magnetron 3. Power transformer 4. Rectifier assembly 5. HV capacitor 6. Primary interlock system
4	Food is unevenly heated in cook cycle	1. Due to Open wiring 2. Defect in Turntable motor 3. Low voltage 4. Wrong operation 5. Dirty oven cavity
5	Cooking power is not working properly	1. Short (or) open wiring 2. Fault in Control Unit
6	Defrost function is not working	1. Defect in Magnetron 2. Wrong Operation 3. Low voltage 4. Dirty Oven

Frequently Occurring Faults in Microwave Oven:

Some of the most commonly occurring faults are as follows,

1. No Heating
2. Intermittent Heating
3. Timing Problem
4. Display Problem

No Heating -

This is one of the common faults that could occur in the microwave oven, that when the microwave oven is turned on and working but the microwave oven fails to heat the food that needs to be cooked. This may be due to the Defect in high voltage diodes. The high voltage diode converts the ac power from the transformer to dc and supplies high voltage to magnetron. In case if the high voltage diode gets burnt, it cannot supply enough energy that is required by the magnetron to generate the microwaves that help to heat the food. In such cases, the high voltage diodes need to be replaced.

Note:

The high voltage diode has to be replaced only by the licensed Field Technician.

Defect in door switch -

In general the microwave oven consists of three to four door switches. Only if all the door switches are properly closed the microwave oven starts to heat the food. If even one of the door switches is not closed properly it does not heat. In some of the cases even if all the switches are closed properly the microwave oven fails to produce heat this may be due a fault in any one or all the door switches so that it is necessary to check the continuity of the door switch by using a digital multimeter. If any of the door switches is found to be faulty then it needs to be replaced and this also should be done by a licensed Technician.

Defect in Magnetron -

The magnetron is the heart of the microwave oven that converts the high energy from the high voltage transformer to the microwaves that cooks food. If the magnetron gets a fault, then it will not be able to generate a microwave so that the food placed inside the oven cannot be heated. When the magnetron gets faults, it is not possible to repair and hence must be replaced. Even when the microwave

oven is plugged off, the high voltage capacitors may be not fully discharged and hence it is advised that a technician must disconnect the electronic components of the microwave oven and replace the magnetron.

Causes for the Defect in Magnetron:

Whenever the microwaves get reflected to the magnetron it leads to overheating of the magnetron.

Intermittent Heating -

Intermittent heating in a microwave oven is one of the defects that is even when the oven turns ON the heating process is done occasionally. The heating system in the microwave oven is designed to work for less than 16 Hours per day in the microwave oven. Like No Heating, Intermittent heating problem is also due to the following causes,

- Defect in high voltage diode
- Defect in magnetron

Timing Problem -

Timing problem in a microwave is due to the fault occurring in the timing circuit. This is because of the following causes,

- Defect in Control Unit
- Defect in AH Sensor

Display Problem -

Display problem is also one of the frequently occurring faults in a microwave oven. Display problem in a microwave oven may be due to the following causes,

1. **Defect in control unit** -This is mainly due to the disconnection of the electronic components in the circuit board. It can be resolved by identifying the disconnected components and soldering them.
2. **Defect in temperature fuse** -Temperature fuse in a microwave oven can be blown sometimes due to overheating or when the temperature exceeds the actual rating of the temperature. Temperature fuses are placed in different parts in different microwave ovens. This fault can be resolved by identifying the blown fuse and replacing it by a field technician.

3. **Defect in shorted (or) open wiring** -This is due to the fault in the shorted (or) open wiring in the microwave oven. In such cases the continuity of the wire

needs to be checked by using a digital multimeter. If it is found that the Wires used are faulty it needs to be replaced by a professional.

- 4. Defect in Monitor switch** -This may be due to the use of fault Monitor switch. In such cases the faulty monitor switch needs to be replaced by a service Technician.

CHECK YOUR PROGRESS

Choose the correct answers

- Magnetron converts the electrical energy from the transformer to the
 - Microwaves
 - Electrical signals
 - Radio waves
 - Infrared
- Solo Microwave ovens can be only used for cooking and
 - Reheating
 - Cooling
 - Grinding
 - Freezing
- In order to spread the microwaves uniformly inside the microwave oven the component used is
 - Blower fan
 - Stirrer fan
 - High voltage capacitor
 - High voltage diode
- The frequency of the microwaves that are generated by the magnetron in the microwave oven is
 - 3.2 GHz
 - 32GHz
 - 24GHz
 - 2.4GHz
- In order to withstand the high Voltage in the microwave oven the component used is
 - High voltage capacitor
 - High voltage diode
 - High voltage transformer
 - Resistor

Fill in the blanks:

- Microwave ovens cannot heat_____.
- The component that plays a major role in the microwave oven is _____.
- _____show the progress of the food that is being cooked in the microwave oven.
- _____ in a microwave oven rotates the food so that the heat is evenly spread.

-
-
5. A Blower Fan in a Microwave oven is used to maintain the _____ of the Magnetron.
 6. The heating system in the microwave oven is designed to work for less than _____ Hours per day.

Answer the following:

1. What is a microwave oven?
2. List the models of microwave ovens.
3. Write the functioning of a microwave oven.
4. Write some of the common features and functionalities of Microwave Oven.
5. Write the Frequently Occurring Faults in microwave oven
6. What are the Causes for the Defect in magnetron?
7. What are the Causes for display problems?

Write a short note on the following:

- A. High voltage capacitor.
- B. High voltage diode.
- C. High voltage transformer.
- D. Cavity lamp
- E. Cooking chamber
- F. Turntable motor
- G. Stirrer fan
- H. Blower fan
- I. Wave guide
- J. Mangnetron

Session 2:

Replace Dysfunctional Module in Microwave

Components/Modules of different Microwave Oven

1. Power Supply Unit
2. Microwave Generation Unit

-
3. Cooking Cavity
 4. Control Panel
 5. Electromechanical Components

Energy Ratings, BEE Ratings and concept of E Waste:

What is energy? -

It is defined as the capability to do the work. Its SI unit is joules.

Energy Ratings of a Microwave Oven -

Modern microwave ovens consume about 1200 watts per 30 minutes on an average and it consumes almost 2 to 7 watts even in standby mode.

BEE Rating -

BEE Stands for Bureau of Energy Efficiency; it is a standard for rating the efficiency of electrical home appliances like washing machine, refrigerator, microwave oven etc., has been launched by the ministry of India. Higher the star rating of BEE for an Electrical Appliances higher will be its energy efficiency and lower will be its energy consumption.

Concept of e Waste -

Electronic waste (e waste) is one of the types of waste where the components used in electronic appliances cannot be replaced or reused or resoled. When this type of e waste is processed informally that could be hazardous for human health and environmental pollution.

e - waste from microwave oven

Microwave oven consists of various electronic components like

- High Voltage Transformers
- High Voltage Capacitors
- High Voltage Diode
- Magnetron

These components, once get damaged, cannot be repaired or recycled, therefore they require proper disposal. Even after disconnecting the magnetron from the supply unit, it is surrounded by oxides which could be toxic. The high voltage capacitors may not be fully discharged even after being disconnected. So, it is important to fully discharge it and dispose of it properly.

CHECK YOUR PROGRESS

Fill in the blanks:

1. Modern microwave ovens consume about _____ watts per 30 minutes .
2. BEE Stands for_____.

Answer the following:

1. List the E- wastes from the microwave oven.

Session 3:

Confirm Functionality of the Repaired Unit

Dismantling Procedure:

- Disconnect the power supply
- Remove the top cover
- Remove the door
- Remove the side covers

Assembling Procedure:

- Make sure that all parts are neat and clean
- Place the oven base at a flat surface
- Place the required tools near to the workplace
- Before assembling, check whether all the equipment is in working condition.
- Connect and check power supply circuits.
- Connect the magnetron in the circuits.
- Fix the cooking cavity in the base
- Fix the control panel and verify its connections.
- Fix the blower fan, stirrer, and grill in the appropriate position.
- Fix the upper moulding cover.
- Give the supply and verify the operation of the microwave oven.

Factors confirming the proper functioning of the repaired/ replaced unit of the microwave oven:

1. **Foods are evenly cooked** -This can be achieved only when the stirrer fan that is placed inside the microwave oven is working in proper condition.
2. **Proper Heat Generation** - This indicates the proper functioning of the magnetron. When the magnetron is working properly it generates sufficient amount of microwaves required to heat the food.
3. **Clear display** - It indicates the proper functioning of electronic components in the control boards.
4. **Temperature of the magnetron is maintained** -This shows that the blower fan is working in good condition as the main function of the blower fan is to maintain the temperature of the magnetron and to prevent it from overheating.

Cleaning and maintaining Process of microwave oven:

The following steps are to be followed while cleaning the microwave oven

1. Before cleaning, check whether the supply is in an off condition. Do not use water (or) liquid cleaners
2. Use soft sponge for cleaning the microwave oven as shown in figure
3. Use baking soda and vinegar for complete cleaning.
4. Don't close the door too hard.
5. Use pot holders for handling containers placed inside the microwave.
6. Don't heat non-food items in the microwave oven for a longer lifetime.
7. Repeat the process to maintain the microwave oven for a longer lifetime.
8. Keep the inner sides of the oven clean.
9. Don't allow the control panel to become wet.



3.13: Cleaning of microwave oven

PRACTICAL

Practical 1 -

Demonstrate the pattern of microwaves.

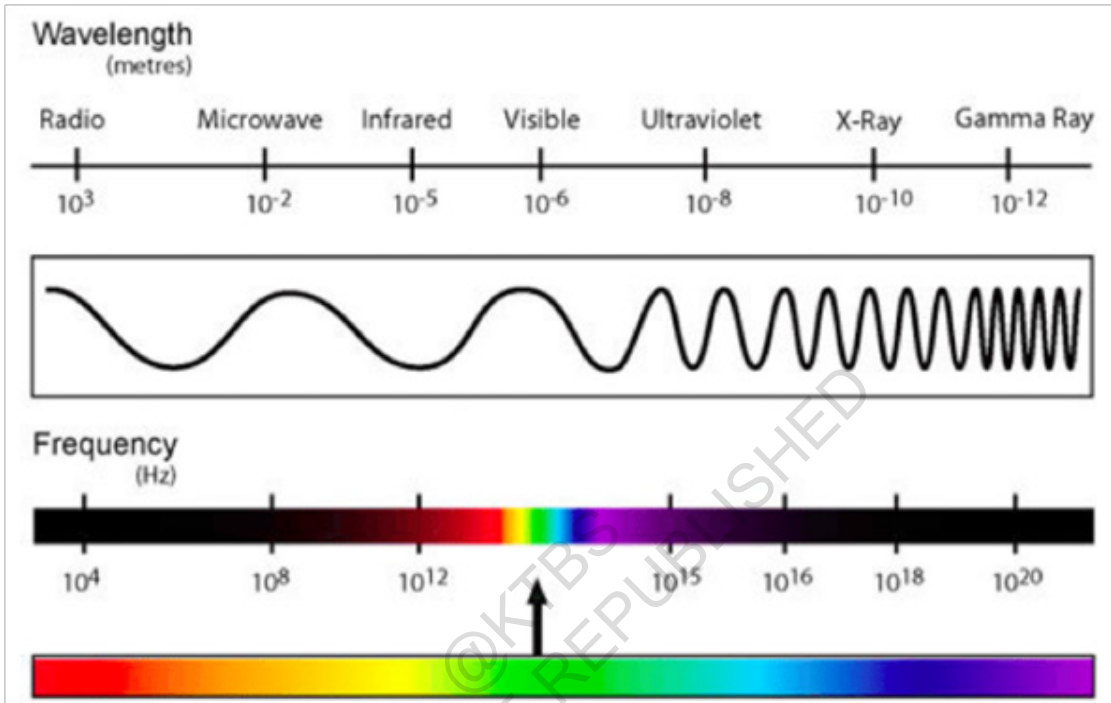


Fig 3.14 : patterns of microwaves

Practical 2 -

Diagnose the fault based on initial inspection:

- Unplug the microwave unit from the power supply.
- Check the power cord using the multimeter.
- Check whether the microwave is generating heat or not.
- Check whether the food is being evenly cooked or not.
- Check whether the display unit is in working condition.
- Control panel in the microwave oven must be checked.
- Identify the exact fault because wrong identification of fault leads to waste of money.

Practical 3 –

Perform Basic Tests

Materials Required –

Multimeter, Microwave Oven, Gloves

Procedure -

Caution: Wear Hand gloves and shoes

- Microwave Oven consists of features like displaying the Input Power, Volt ampere rating and whether the Earthing is in proper condition.
- It can be seen in the microwave oven display by changing the settings.
- In case of any fault in the control circuit, it indicates it in the display.
- In case of any fault, Unplug the microwave oven from the power supply.
- Wear Shoes and Gloves.
- With the help of the multimeter check the power supply, Volt ampere test and Earth Test.

Practical 4 –

Demonstrate to disassemble and inspect every component of the microwave

1. Testing of high voltage capacitor

Materials required:

- Faulty microwave oven
- Multimeter
- Connecting probe
- Screw driver
- Cutting plier
- Gloves
- Line tester

Procedures:

Caution: Wear Hand gloves and shoes because the microwave oven consists of High voltage capacitors which could be hazardous because they may not be fully discharged even after unplugging from the main supply.

-
- Unplug the microwave oven from the main supply.
 - Wear hand gloves
 - Remove the upper cover
 - Remove the faulty capacitor by using cutting plier
 - Check the output capacitance of the capacitor by using multimeter
 - If the multimeter shows the reading above 0.9 MF considered as working, if not it's not working.

2. Test and replace interlock switches of microwave oven not working properly using multimeter and a power probe

Materials required:

- Multimeter
- Power cord

Procedures:

- Unplug the plug from power supply
- Check the resistance by using digital multimeter
- If it is found to be faulty then the switch has to be replaced.

3. Testing of microwave leakage test:

Materials required:

- Multimeter
- Power probe
- Microwave survey meter
- Hola day H1-1500
- Hola day H1-1501
- Narda 8100
- Narda 8200
- Glass thermometer 1000c

Procedures:

- Place the beaker filled with water in the oven.
- Operate the oven at its maximum output range.
- Use a probe to measure the microwave.

4. Testing of the voltage transformer:

Materials required:

- Faulty microwave oven
- Multimeter
- Screw driver
- Stripper
- Cutting plier
- Hand gloves

Procedures:

- Caution: Wear Hand gloves and shoes.
- Unplug the main power supply
- Wear hand gloves
- Remove the upper cover
- Remove the wires of the primary side of the transformer and then Remove the wires of the secondary side
- Microwave oven has two types of secondary winding
- 3.1V to 3.2V
- 1800V to 2800V
- Check whether the light is in on condition, if it's not, change the light
- If still the light is not glow then fault available in secondary side
- Check the continuity of the transformer by using multimeter
- Check whether the transformer is in short circuit condition.

Practical 5 -

Frequently occurring faults

Materials Required:

- Faulty Microwave oven
- Multimeter
- Cutting Plier

-
- Screwdriver
 - Gloves
 - Soldering Iron
 - Soldering Lead
 - Soldering Paste.

Procedure:

Case 1: Even if the Microwave oven is in ON condition, it does not heat food.

- Unplug the microwave oven from the power supply.
- Remove all the screws and remove the upper cover.
- Wear Gloves and Shoes.
- Disconnect the wires which are connected to the magnetron, High Voltage capacitor, High voltage diode with the help of the cutting plier.
- Check the resistance using the multimeter.
- If any of the components are found to be defective then it needs to be replaced.

Case -2: If the food is not evenly cooked

- Unplug the microwave oven from the power supply.
- Remove all the screws and remove the upper cover.
- Wear Gloves and Shoes.
- Remove the stirrer fan that is placed in the cooking cavity with the help of the Screwdriver and Cutting plier.
- If it is found to be faulty then it needs to be replaced.

Case- 3: Timing and Display Problem

- Unplug the microwave oven from the power supply.
- Remove all the screws and remove the upper cover.
- Wear Gloves and Shoes.
- Check whether all the components in the control board are properly connected.
- If any one of the components is found to be disconnected then it needs to be soldered correctly with the help of the soldering Iron.

Case – 4: No heating due to the fault in Door Switches.

- Unplug the microwave oven from the power supply.
- Remove all the screws and remove the upper cover.
- Wear Gloves and Shoes.
- If there is a defect in any one of the door switches, then the microwave oven does not heat the food.
- Check the continuity of the switches with the help of the multimeter.
- If the switch does not have continuity then it needs to be replaced.

Case – 5: If the temperature fuse gets blown

- Unplug the microwave oven from the power supply.
- Remove all the screws and remove the upper cover.
- Wear Gloves and Shoes.
- The temperature fuse will be placed in different places in different microwave ovens. It must be identified.
- If the fuse is found to be blown or burnt it needs to be replaced.

Case – 6: If cavity lamp does not glow then the oven does not work

- Unplug the microwave oven from the power supply.
- Remove all the screws and remove the upper cover.
- Wear Gloves and Shoes.
- Check for the availability of Continuity in the following components,
 - a. Interlock Switch
 - b. Timer Switch
 - c. Fuse
 - d. Cavity Thermostat
 - e. Magnetron Thermostat
- If any one of the components does not have the continuity then the particular component has to be replaced.

Practical 6 -

Demonstrate to replace component for Identified Fault

Materials Required:

- Faulty microwave oven
- Screwdriver
- Cutting Plier
- Gloves.

Procedure:

- Unplug the microwave oven from the power supply.
- Remove all the screws and remove the upper cover.
- Wear Gloves and Shoes.
- After identifying the faulty component, remove them with the help of the Cutting Pliers and Screwdriver.
- Care should be taken while removing parts like High Voltage Capacitor, High-voltage Diode and Magnetron because even when not connected to the power supply High Voltage capacitor may not have fully discharged that could be hazardous.
- Replace the faulty component with new components carefully.

Practical 7 -

Demonstrate to remove and replace the faulty module with a functional one at PCB Level

Materials Required:

- Faulty Microwave Oven
- Soldering Iron
- Soldering Paste
- Soldering Lead
- Screwdriver
- Cutting Pliers.

Procedure

- Unplug the microwave oven from the power supply.
- Remove all the screws and remove the upper cover.

-
- Wear Gloves and Shoes.
 - Identify the faulty component in the PCB Board.
 - Remove the faulty component from the PCB Board with the Soldering Iron.
 - Replace it with a newly bought Component with the help of the Soldering Iron, Soldering Paste, Soldering Lead.

Practical 8 -

Demonstrate to reassemble the microwave oven

Materials Required:

- Faulty Microwave Oven
- Screwdriver
- Cutting Pliers.

Dismantling process:

- Disconnect the power supply
- Remove the top cover
- Remove the door
- Remove the side covers

Assembling procedures:

- Make sure that all parts are neat and clean
- Place the oven base on a flat surface
- Place the required tools nearer to the workplace
- Before assembling, check whether all the equipment is in working condition.
- Connect and check power supply circuits.
- Connect the magnetron in the circuits.
- Fix the cooking cavity in the base
- Fix the control panel and verify its connections.
- Fix the blower fan, stirrer fan and grill in the appropriate position.

-
- Fix the upper moldings cover.
 - Give the supply and verify the operation of the microwave oven.

Practical 9 -

Demonstrate and conform functionality of the repaired microwave oven

Procedure:

1. After the identification of the fault and the cause of the fault. If the faulty component is found that it cannot be repaired, then the component must be replaced.
2. Once the Faulty components are replaced. It is necessary to demonstrate and to check the functionality of the repaired microwave oven.
3. It can be done by following the steps given below
 - Check whether the microwave oven is generating heat. This indicates that the magnetron is in proper condition.
 - Check that the food is evenly cooked. This indicates that the stirrer fan is working in proper condition
 - Check whether the temperature of the magnetron is within the rated temperature. This indicates the proper functioning of the blower fan.
 - Check the display and observe that it is operating in normal condition. This shows that the control circuit is working in proper condition.

Practical 10 -

Demonstrate the cleaning and maintenance procedures of microwave oven

Caution: Wear Hand gloves and shoes.

The following steps are to be followed while cleaning the microwave oven

1. Before cleaning check whether the supply is in off condition.
2. Do not use water (or) liquid cleaners
3. Use soft sponge for cleaning the microwave oven
4. Use baking soda and vinegar for complete cleaning.
5. Don't close the door too hard.
6. Use pot holders for handling containers that are present inside the microwave oven.

-
7. Don't heat non-food items in the microwave oven for longer use.
 8. Repeat the process to maintain the microwave oven for longer use.
 9. Keep the chamber clean.
 10. Don't allow the control panel to become wet

CHECK YOUR PROGRESS

Answer the following :

1. Write about the reassembly process of the microwave oven.
2. Write about the dismantling process of the microwave oven.
3. Write the Factors confirming the proper functioning of the repaired/ replaced unit of the microwave oven.
4. Write the Cleaning and maintenance Process of microwave oven.

Tips for Vocational Trainer

1. Take the students to any Microwave Oven Service Centers.
2. Conduct a Guest Lecture and ask the resource person to explain and demonstrate the microwave oven.

Activity -

Conduct debate about the merits and demerits of microwave ovens.

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2. <https://www.youtube.com/watch?v=VLrYXd1RXvs>
3. <https://www.youtube.com/watch?v=bUsS5KUMLvw&pp=ygUhd29ya2luZyBvZiBtYWduZXRYb24gaW4gbWljcm93YXZl>

QR Code for the above video links:



Unit 4



MAINTAIN HEALTH AND SAFETY

Learning outcomes

- 1) Understand the concept of personal health
- 2) Know the safety measures while handling electronic equipments

Introduction:

Electrical and Electronic devices play a major role in our daily life that may cause some issues like repair, replacement etc. At that time, some safety measures need to be followed for our health and Safety. This lesson mainly focuses on personal health and safety measures while working with electronic devices.

Session 1: Observe Personal Health and Safety:

Personal Health:

Personal health refers to the wellness of the human being. whilst personal health care is provided to the public those who are not able to take care of themselves. Personal Health is the capacity to take charge of your health by making mindful decisions to be healthy. It not only refers to the physical well being of an person but it also comprises the wellness of emotional, intelligence, social, inexpensive, religious and other areas of life.



SAFETY:

Safety refers not only to physical safety but also to psychological safety, which involves liberty from worry about physical safety as well as being mistreated by unfriendliness, anger, and annoyance. Evaluating physical and psychological safety means stress, not only bright lights, but also a warm polite environment.



WHAT IS PERSONAL SAFETY?

Everyone's right of use to academic excellence, education, and career success are gravely compromised when physical and psychological safety is in question. An optimistic, open, and supportive surroundings can add to learning and academic excellence. Communications with trainers, friends, relatives, co-workers, and peers which are helpful, friendly, supportive, focused, caring and trusting are key contributors to success and career performance.

Safety Precautions to be taken while installation, repair, and Maintenance of Appliances.

Home appliances, also called domestic appliances, are electrical machines which help in household functions, like cooking, cleaning, or food preservation. Home appliances can be divided into three classifications, which includes, small appliances, major appliances, or white goods and consumer electronics, or brown goods in the United Kingdom.

Follow the below steps for safety while installing electronic devices.

1. Wear safety gloves and shoes while installing the devices.



Fig 4.1 : Hand gloves



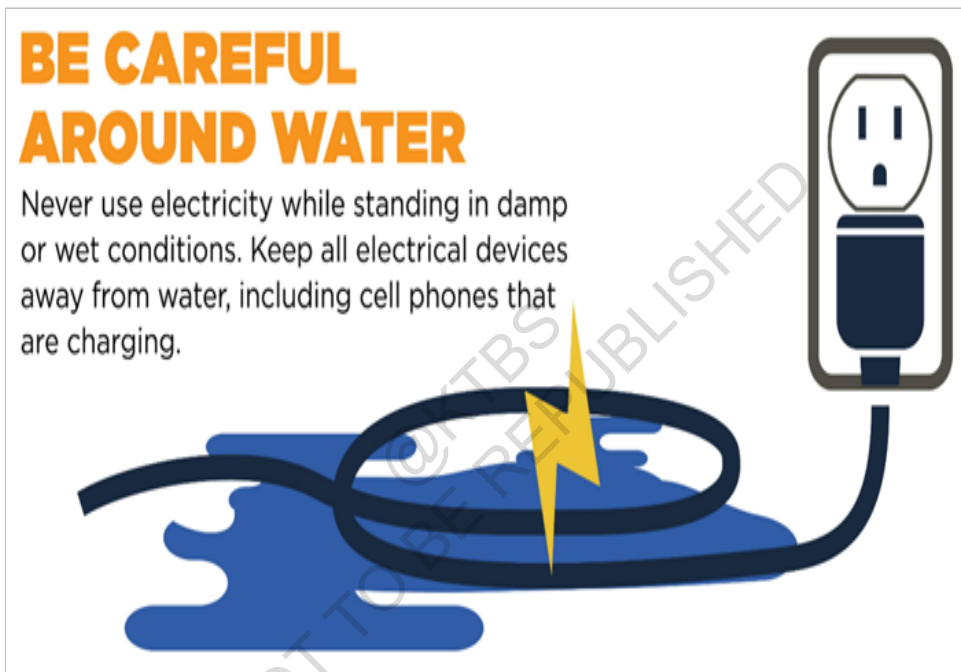
Fig 4.2 : shoes



Fig 4.3 : first aid kit



-
2. Make sure that all the electrical switches are in OFF condition.
 3. Avoid loose cables, wires, and connections.
 4. Keep the first-aid box nearby.
 5. Make sure that all the connections are properly grounded.
 6. Don't wear jewelry made up of conducting materials like silver, copper, etc.
 7. Water content should not present at the place of installation



8. Install the devices with the help of professionals only.
9. Don't touch the electrical switches and power supply with a wet hand.

SAFETY PROCEDURES TO BE FOLLOWED DURING REPAIR:

Faults will occur in all the electronic devices after some time period. It can be identified by degrading their performance. Many of us will not repair the devices for a long time. But costly devices like microwave oven, mixers cannot be kept like that. We must call the professional immediately to repair it.



Fig 4.4 : Repair tools

This topic focuses on safety measures during repairs.

1. Check whether the connection is off state.
2. Cut off the power supply before changing the fuse.
3. Wear gloves and shoes.
4. Use the appropriate device for repairing.
5. After repairing, close the appliance properly before checking.



6. Keep the phones, first aid box and fire extinguisher nearby.
7. There should be Proper ventilation in the Workplace.
8. Don't keep inflammable substances nearby
9. Don't use insulation tapes for damaged wires/cables, replace the entire cable.

Safety Procedures to be followed during Maintenance:

Every electronic equipment's performance is based on the maintenance of it. Regular maintenance should be done with the help of professionals. In this topic, we are going to discuss the safety procedures to be followed while maintenance.



Fig 4.5: Stabilizer

Follow the below steps for safety during maintenance,

1. High voltage will damage the equipment, use a stabilizer to avoid this.
2. Don't operate the switches with a wet hand.
3. Through proper service, we can avoid accidents.

-
4. Don't wash the equipment without the professional's advice.
 5. Follow the instructions given in the user manual.
 6. Dispose the waste materials properly.

PACKAGING WASTE DISPOSAL PROCEDURES:

This session focuses on packaging waste management techniques. The immediate question arises is what is packaging? Packaging refers to all those behaviors related to scheming, validating, and producing the container for a product. Simply, the box-like container, wherein the product is stored to guard it from any physical harm and at the same time attracting the customer throughout its demand is called packaging.

IDENTIFYING THE WASTES:

Packaging is anything used to guard, handle, carry or present raw materials and processed products. It includes,

- Boxes
- Labels
- Bags and Sacks
- Pallets
- Containers
- Tape and materials for wrapping, binding, and tying
- Crates
- Tubes and Cores

PROCEDURES:

1. First open the package safely with the help of a knife.
2. Identify the waste materials.
3. Collect all waste ropes, cello tapes, and staple pins.
4. Classify the bio – degradable and non-biodegradable wastes.
5. Dispose the wastes in their proper dustbins.

SAFETY RULES, POLICIES AND PROCEDURES:

COMMON SAFETY MEASURES

- Your safety is your personal and first duty.
- Every time follow the proper procedures.
- Never take shortcuts.
- Take responsibility and clean up if you made a mess.
- Clean and classify your workspace.

-
- Make sure a clear and easy route to emergency exits and equipment.
 - Be alert and awake on the job.
 - Always pay special attention to your work surroundings.
 - When in hesitation, contact your higher officials or manager for instruction, direction, or training.
 - Never take risks when it comes to safety.
 - Follow safety signs, stickers, and tags.
 - Take short breaks when you keep up a recurring action for a long period of time, and sit, stand, or walk with a good attitude.
 - Escalate severe injuries suddenly to a manager and get urgent situation help.
 - Keep things in perspective. Hazards may be unlimited, so concentrate on the majority probable risks first.

SAFETY IS A TEAM EFFORT:

- Teach everyone in the workplace about the safety necessity and consider posting a list of workplace safety guidelines. A workplace safety training shall help them decrease or remove injuries and illness from happening in the workplace.
- At all times keep the communication lines open with your co-workers, employers, or workers in order to encourage and keep a safe environment.
- Straight away inform others of any hazards that you identify.
- Be alert to hazards that could influence any person; in this respect, always maintain a team attitude.
- Report a harmful state instantly to your manager or higher officials.
- Be aware as to what others are doing around you, and try to do your best too.
- Make sure you don't create a risk to them.
- If you're a manager, request and engage your workers in safety development, give and take suggestions, and make sure that each person is on the same side.

USING TOOLS IN A SAFE MANNER:

-
- Use equipment only if you're certified, trained, and prepared.
 - Every time use the suitable tool for the personal task.
 - Clean your tools and maintain them and make sure they function well.
 - Arrange your tools and don't be casual; someone could simply fall due to misplaced equipment.
 - Every time make sure that the machinist of an equipment sees you; never move backward or from a sightless side.
 - Don't do a task unless you have been skilled and you are aware of the hazards as well as how to remove them.
 - Don't eliminate protection guards that are in place to defend you and the nearby area.
 - Follow all operating procedures.
 - If something is wrong, stop the equipment straight away and get help.

HAZARDS, THEIR CAUSES AND PREVENTION:

Hazard is defined as any harmful substance which affects human health. Electricity is fundamental for all electronic devices. In this topic we are going to discuss electrical interruptions.



1. VOLTAGE:

Electrical lines with high voltages can cause major harm to workers. Keep a minimum distance of 10 feet.



2. Damaged Tools and Equipment:

Using damaged electrical tools and equipment can be very dangerous.

3. Poor Wiring:

Using wires with unsuitable size for the current can cause overheating and fires to occur. Use the proper wire process and the electrical load to work on.



appropriate for the
Fig 4.6 : poor wiring

4. Uncovered Electrical Parts:

Exposed electrical parts include temporary lighting, open power sharing units, and removed insulation parts on electrical cords. These hazards can cause possible shocks and burns.

5. Inappropriate Grounding:

Appropriate grounding can reduce useless voltage and reduce the risk of Current. Don't eliminate the ground pin as it is responsible for returning unnecessary voltage to the ground.

Poor Insulation:



Faulty or poor insulation is a danger. Be aware of Poor insulation and inform it instantly. Turn off all power sources before replacing poor insulation and don't try to cover them with electrical tape.

PERSONAL SAFETY PROCEDURES:

Follow the below given instructions while working with electronic appliances,

- Do not handle the appliances without proper practices.
- Do not open the package and use the appliance without the professionals or technician.
- Ladder, drilling machine and stool should be in good condition.
- Do not wear loose dresses because it may get stuck into the devices.
- Do not place the conductors on electronic appliances.

GENERAL PRECAUTIONS:

- Your safety is your personal responsibility.
- Always follow the correct procedures.
- Never take shortcuts.
- Be alert and awake on the job.

-
- Be always attentive to your work surroundings.
 - Never take risks when it comes to safety.

Practical 1 -

Demonstrate to take safety precautions to be taken while installation, repair, and maintenance of appliances.

Procedure:

1. Wear hand gloves and shoes before starting the Installation Process.
2. Turn OFF all the electrical switches.
3. Do not install the electrical appliance with wet hands.
4. Avoid using loose cables.
5. While installing electrical appliances must be installed with proper equipment.

Practical 2 -

Demonstrate the packaging waste and its disposal.

Procedure:

1. Open the package safely by using a knife.
2. Identify the waste to be disposed of.
3. Separate the biodegradable and non-biodegradable waste.
4. Dispose the waste in the proper way.

Practical 3 -

Observe safety rules and procedures.

Procedure:

1. Your safety is your personal and first duty.
2. Every time follow the proper procedures.
3. Never take shortcuts.
4. Take responsibility and clean up if you made a mess.
5. Clean and classify your workspace.
6. Make sure a clear and easy route to emergency exits and equipment.
7. Be alert and awake on the job.

-
8. Always pay special attention to your work surroundings.
 9. When in hesitation, contact your higher officials or manager for instruction, direction, or training.
 10. Never take risks when it comes to safety.
 11. Follow safety signs, stickers, and tags.
 12. Take short breaks when you keep up a recurring action for a long period of time, and sit, stand, or walk with a good attitude.
 13. Escalate severe injuries suddenly to a manager and get urgent situation help.
 14. Keep things in perspective. Hazards may be unlimited, so concentrate on the majority probable risks first.

Practical 4 -

Demonstrate to avoid hazards during repairs, using tools and materials.

Procedure:

1. Electrical lines with high voltages can cause major harm to workers. Keep a minimum distance of 10 feet.
2. Use proper equipment while doing repair work.
3. Use the proper wire appropriate for the process and the electrical load to work on.
4. Don't eliminate the ground pin as it is responsible for returning unnecessary voltage to the ground.
5. Turn off all power sources before replacing poor insulation and don't try to cover them with electrical tape.
6. Do not handle the appliances without proper practices.
7. Do not open the package and use the appliance without the professionals or technician.
8. Ladder, drilling machine and stool should be in good condition.
9. Do not wear loose dresses because it may get stuck or get entangled in the device.
10. Do not place the conductors on electronic appliances.

CHECK YOUR PROGRESS

Choose the correct answer

1. Select the conducting material from the below option.
a Silver b Wood
c Sandd d None of the Above
2. _____ is used to avoid high voltage fluctuations.
a Plug b Switch
c Stabilizer d Wire
3. _____ is needed to avoid head injury.
a Shoe b Gloves
c Helmet d Shirt
4. Correct way to dispose of the waste material is _____.
a Classify them and throw it in dustbin b Keep it in the same place
c Don't do anything d None of the Above
5. Faulty part in the microwave oven must be _____ immediately.
a Replace b Reused
c Both a & b d Do thing

VERY SHORT ANSWERS:

1. List any 2 electrical hazards.
2. Write the steps involved in the waste disposal procedure.
3. List out the things used for packaging.

SHORT ANSWERS:

1. Write down the safety procedures to be followed during installation.
2. Write down the safety procedures to be followed during Repair.
3. Write down the safety procedures to be followed during maintenance.
4. Write down the personal safety procedures.

TIPS FOR VOCATIONAL TRAINER:

-
- Take the students to nearby electrical or electronic industry to show how the workers doing work with proper safety equipment.
 - Make the students identify the safety equipment that they wear.
 - Discuss with the workers about the safety, health, and maintenance in working area.

ACTIVITY:

- Inform the students to collect the information about health and safety through the internet.
- Collect and Paste the pictures of simple safety equipment.

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VOCABULARY

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- Capacitor: An Electrical Component Which Uses Electrostatics to Store Energy
 - Current: A Flow of Electric Charge (Such As Electrons or Ions)
 - Electrical Circuit: A Network or Interconnection of Electronic Components in A Closed Loop
 - EMF (Electromotive Force): Energy Measured In Volts; Refers To the Potential Which Causes the Flow of Electrons (And Ions) In A Conductor
 - IC (Integrated Circuit): A Set Of Electronic Interconnections In A Small "Chip" Or Plate Where All The Elements Are Inseparable
 - Light Bulb: A Source of Electric Light Which Uses a Filament Stored In A Glass Enclosure
 - Led (Light-Emitting Diode): A Semiconductor Source of Light
 - PCB (Printed Circuit Board): A Laminate Board Which Supports Electric Components in the Circuit
 - Resistor: An Electrical Component, Which Restricts The Flow Of Electrons In The Circuit
 - Solar Cell: An Electrical Device Which Converts The Energy From Light Into Electricity
 - Soldering Iron: A Handy Tool Used To Assemble The Electrical Components On a PCB (Printed Circuit Board).
 - Voltage: Also Known As "Electric Tension", Is A Difference Between Electric Potential Between Two Points
 - Diode: A thermionic tube having two electrodes; used as a rectifier
 - Inductor: An electrical device (typically a conducting coil) that introduces inductance into a circuit
 - Transformer: An electrical device changing one voltage to another
 - Semiconductor: A substance as germanium or silicon whose electrical conductivity is intermediate between that of a metal and an insulator; its conductivity increases with temperature and in the presence of impurities
 - Switch: Device for making or breaking the connections in a circuit
 - Circuit: An electrical device providing a path for current to flow
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- Insulator: A material with little electrical or thermal conductivity
 - Ampere: The basic unit of electric current
 - Volt: A unit of potential equal to the potential difference between two points on a conductor carrying a current of 1 ampere when the power dissipated between the two points is 1 watt; equivalent to the potential difference across a resistance of 1 ohm when 1 ampere of current flows through it
 - Watt: A unit of power equal to 1 joule per second
 - Joule: A unit of electrical energy
 - Ohm's Law: The relationship between voltage, current and resistance.
 - Ohm (Ω): The unit of measure for resistance.
 - Farad (F): The unit of measure for capacitance.
 - Ground: A common name for the reference point in an electrical circuit at which the measured voltage is taken to be zero.
 - Electronics: The science and technology concerned with and based on electricity and its applications.
 - Direct Current (DC): Current that flows across a material in one direction only.
 - Digital Circuit: A circuit in which inputs and outputs have only two possible states: low (0) or high (1).
 - Atom: (physics and chemistry) the smallest component of an element having the chemical properties of the element
 - Electron: An elementary particle with negative charge
 - Neutron: An elementary particle with 0 charge and mass about equal to a proton
 - Proton: A stable particle with positive charge equal to the negative charge of an electron
 - Short circuit: A connection that allows current to take an unintended path

FIELD TECHNICIAN AND OTHER HOME APPLIANCES

MODEL QUESTION PAPER - 1

(QUALIFICATION PACK : Ref. Id. ELE/Q3104)

CLASS: X

(MARKS : 60)

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its question number and alphabet : $10 \times 1 = 10$

1. Identify the active electronic component in the following :
(A) Inductor (B) Resistor
(C) Capacitor (D) LED
2. Circuit breaker used in the stabilizer is
(A) Relay (B) Fuse
(C) Motor (D) Generator
3. Which of the following is NOT the part of a mixer ?
(A) Belt (B) Blade
(C) Coupler (D) Speed setting switch
4. The alternate name of masticating juicer is
(A) Wine press (B) Hot press
(C) Cold press (D) Twin gear
5. In a relay circuit, the bearing used for high sensitivity and low friction is
(A) Jewel bearing (B) Single ball
(C) Pivot ball (D) Multi-ball
6. The voltage of three phase supply system is
(A) 230 V (B) 332 V
(C) 415 V (D) 220 V
7. Which part of the microwave oven converts electrical energy into microwaves ?

(A) Turntable motor

(B) Wave guide

(C) Cavity lamp

(D) Magnetron

8. To withstand high voltage in a microwave circuit, the the component is

(A) Transformer

(B) Diode

(C) Transistor

(D) Lamp

9. While working with high voltage electrical lines minimum distance to be maintained is

(A) 4 feet

(B) 50 feet

(C) 10 feet

(D) 20 feet

10. The use of blower fan in microwave oven is to

(A) maintain the temperature

(B) increase the temperature

(C) decrease the temperature

(D) release the heat

II. Fill in the blanks with suitable answers.

$4 \times 1 = 4$

11. Transformer supplies to the magnetron.

12. The manual-styled juicer used for extracting the juice from fruits is

13. Microwave oven is designed to work for almost hours per day.

14. Tubes are type of waste.

III. 15. Parts of the mixer are given in Column-A and their functions are given in Column-B. Match them and write answers with alphabet :

Column-A

i) Jar

ii) Overload switch

iii) Field and armature

iv) Power cable

Column-B

a) Gives rotating movement to the jar

b) Vessel containing blades

c) Grinds the food

d) Indicates the availability of a mixer

e) Supplies electricity

f) Cut-off the supply automatically

g) Varies the speed

IV. Answer the following questions :

$6 \times 1 = 6$

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16. List the models of microwave ovens.
 17. What is the use of a tachometer ?
 18. What is the function of a stirrer fan in a microwave oven ?
 19. What happens if the wiring is poor ?
 20. Write the use of a circuit breaker.
 21. Which part of the microwave oven is used to monitor the cooking process ?

V. Answer the following questions :

$6 \times 2 = 12$

22. What is a fuse ? Write the types of fuse.

OR

Write the two laws of Faraday.

23. Draw the diagram of wave winding.
24. Write any four components of the mixer.

OR

Name the components of the juicer.

25. What are the precautions to be taken to maintain the jar for the long term ?
26. What are the steps to be followed while installing electronic devices ?
27. What are the reasons for no response even after pressing the stop / clear button in a microwave oven ?

VI. Answer the following questions :

$4 \times 3 = 12$

28. What is electromagnetic induction ? Draw the diagram showing this experiment.
29. What is a mixer ? Write the cleaning process of the jar of a mixer.

OR

Write the cleaning procedure of the blade and base unit of the mixer.

30. Write the functions of the following parts of the microwave oven :
 - i) Interlock
 - ii) High voltage diode
 - iii) High voltage transformer.

31. Microwave oven is not heating food due to problem in high voltage capacitor. How do you check and replace it ? Explain.

VII. Answer the following questions :

3 × 4 = 12

32. Mention the functions of the following parts of motor :

- i) Yoke
- ii) Armature
- iii) Teeth
- iv) Slot

OR

Explain the working principle of relay.

33. Draw the diagram of the wet grinder and mention any two parts.

34. List the procedures to be followed for cleaning and maintenance of the microwave oven.

OR

Write the steps to assemble the microwave oven