**BASIC TECHNOLOGY JSS 1**

**THIRD TERM**

# **SCHEME OF WORK**

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| 2 | WOOD WORK HAND TOOLS-BORING TOOLS, CUTTING TOOLS |
| 3 | WOODWORK HANDTOOLS (CONTD.) –DRIVING AND IMPELLING TOOLS, HOLDING DEVICES, CARE AND MAINTENANCE. |
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**REFERENCE MATERIALS**

* MELROSE, Basic Science and Technology Book 1
* NERDC, Basic Technology for JSS, Book 1

**WEEK ONE**

**REVISION**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a universal language used for communication among technical people.

(a) Scaling

(b) Technical drawing

(c) Sketching

(d) Oblique

2. Technical people include the following except:

(a) engineers

(b) technicians

(c) builders and draughtsmen

(d) lawyers

3. Which of the following is not a drawing instrument?

(a) set squares

(b) French curve

(c) microscope

(d) pencil

4. The following are ways of caring for a tee square except:

(a) use it as a toy gun

(b) never use the tee square as a walking stick

(c) do not use a pen knife or blade along the edge of the tee square

(d) always hang your tee square after use

5. Set squares are used to draw the following inclined angles except:

(a) 30°

(b) 60°

(c) 45°

(d) 70°

6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is one of the quickest methods by which the shape of an object can be communicated to others.

(a) Technical drawing

(b) Freehand sketching

(c) Scale drawing

(d) Isometric drawing

7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be defined as the shortest distance between two points.

(a) Straight line

(b) Curve

(c) Circle

(d) Square

8. Isometric view is at \_\_\_\_\_\_\_ to horizontal at both sides.

(a) 30°

(b) 45°

(c) 60°

(d) 90°

9. Oblique drawing is at \_\_\_\_\_\_\_ to the horizontal at one side.

(a) 30°

(b) 45°

(c) 60°

(d) 90°

10. The following are the advantages of freehand sketches except:

(a) A good sketch reduces the task of writing needed to describe the object in the mind of the designer.

(b) The ability to make freehand sketching is a valuable asset for practical engineering work.

(c) Laypersons can express themselves through freehand sketches.

(d) Materials are wasted by freehand sketches.

11. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be defined as the accurate representation of objects in a determined proportion.

(a) Scale drawing

(b) Freehand sketches

(c) Technical drawing

(d) Isometric drawing

12. In \_\_\_\_\_\_\_ scale drawing, the object is drawn to the same size as the actual size, e.g., 1:1.

(a) enlarged

(b) reduced

(c) full

(d) proportioned

13. In \_\_\_\_\_\_\_ scale drawing, the actual size of the object is reduced in proportion to the drawing. It is used when the object is too big. Examples include 1:2, 1:5, 1:10, 1:50, 1:100.

(a) enlarged

(b) reduced

(c) full

(d) proportioned

14. In the scale expressed below, 50 is the \_\_\_\_\_\_\_ of the object: 50:1.

(a) actual size

(b) drawing size

(c) proportioned

(d) regular

15. \_\_\_\_\_\_\_ scale drawing is used when the object to be drawn is too small to be clearly seen.

(a) Enlarged

(b) Reduced

(c) Full

(d) Proportioned

**WEEK TWO**

**WOODWORK HAND TOOLS-BORING TOOLS, CUTTING TOOLS**

**BORING TOOLS**

Boring tools are essential for creating holes in wood. The main types of boring tools include:

1. The Brace: This tool is used to hold and turn drill bits or twist drills when making holes. There are two types of braces: plain brace and ratchet brace.

Components of a brace include:

- The head: Made of hard wood, it is designed to fit comfortably in the user's hand and is attached to a steel sleeve that fits over the crank rod, running on hardened steel balls.

- The crank: A rectangular bent metal rod that fits into a hardwood or plastic handle, allowing for circular motion, referred to as the "sweep of the brace."

- The chuck: The end of the crank is enlarged, threaded, and slotted to receive the socket and jaws.

- The ratchet: A mechanical device added to the brace, enabling hole drilling in tight spaces like corners and restricting bit rotation to one direction.

2. Bits: Bits are tools used in woodwork, often equipped with a threaded center point for efficient hole creation. Types of drill bits include:

- Twist drill

- Twist bits or auger

- Countersink bits

3. Bradawl: This tool is employed to create small holes in wood before inserting screws or nails. It can also be used for marking hole positions before drilling.

4. Gimlet: Primarily used for making holes in wood before inserting small screws and nails.

EVALUATION

1. What are boring tools?

2. List three types of boring tools and describe their uses.

CUTTING TOOLS

Saws are pivotal for cutting wood into various parts. The saw teeth are alternately set left and right to ensure efficient cutting.

TYPES OF SAWS:

1. Rip Saw: Used for cutting along the grain of wood, typically with 4-5 points per 25mm and a length of 610-710mm.

2. Cross-Cut Saw: Employed for cutting wood across the grain, resembling the rip saw but shorter at 460mm-10mm and having 6-9 points per 25mm.

3. Panel Saw: Versatile and capable of performing the tasks of both rip and cross-cut saws, typically measuring 460-550mm.

4. Back Saw: Named for its steel or brass back, which includes:

- Tenon Saw: Used for cutting tenon joints and small jobs on benches, with 12-14 points per 25mm and a length of 200-350mm.

- Dovetail Saw: Ideal for dovetailing and similar small tasks, with an open handle and a length of 200-260mm, featuring 20 points per 250mm.

5. Coping Saw: Suitable for cutting precise curves in thin wood and plywood, with a blade that can be adjusted for various cutting directions. Blade length is about 150mm with approximately 14 points per 25mm.

6. Fret Saw: Employed for intricate shapes and curves in plywood and veneers, featuring a finer blade compared to the coping saw and a high frame for versatile use.

EVALUATION QUESTIONS

1. What is a saw?

2. Name seven types of saws.

3. Describe the fret saw and panel saw, including their uses.

PLANES

Planes are tools for shaping and smoothing wood surfaces. Common types include:

1. Jack Plane: A versatile plane used for planing rough timber surfaces and sizing wood. Typically measures 250mm to 380mm in length.

2. Smoothing Plane: Used after the jack plane for final surface smoothing. Typically 140mm to 250mm in length.

EVALUATION QUESTIONS

1. List three types of planes.

2. State the functions of the mentioned planes.

THE CHISEL

A chisel is a cutting tool made from high carbon steel, primarily used for shaping wood, with final finishing achieved through filing or other means.

TYPES OF CHISELS:

1. Flat Chisel: Used for general workshop purposes, such as leveling surfaces and removing rough areas.

2. Cross-Cut Chisel: Ideal for creating narrow grooves, keyways, and slots in shafts or holes.

3. Round Nose Chisel: Employed for making oil grooves in shafts or holes.

4. Diamond Nose Chisel: Used for cutting inside corners and creating "Vee" grooves.

EVALUATION QUESTIONS

1. Define a chisel as a cutting tool.

2. List four types of chisels and describe their uses.

GENERAL EVALUATION QUESTIONS

1. Explain the uses of the following woodworking cutting tools: (a) Dovetail saw, (b) Tenon saw, (c) Spokeshave.

2. Define boring tools and provide four examples along with their uses.

3. Name four types of chisels and describe their applications.

WEEKEND ASSIGNMENT

1. Which type of saw can perform the tasks of both rip and cross-cut saws?

(a) Tenon saw

(b) Dovetail saw

(c) Panel saw

(d) Back saw

2. When sharpening, why is oil added to the sharpening stone?

(a) To prevent the stone from burning

(b) To prevent the stone from cutting

(c) To prevent the work from clogging

(d) To prevent the stone from clogging

3. Which type of saw is used for cutting complex curves in plywood and veneer?

(a) Tenon saw

(b) Fret saw

(c) Dovetail saw

(d) Back saw

4. In a scale drawing expressed as 1000m:1m, what kind of scale drawing is it?

(a) Full size

(b) Enlarged

(c) Reduced

(d) Proportioned

5. Which method provides an accurate representation of objects?

(a) Freehand sketching

(b) Ordinary drawing

(c) Scale drawing

(d) Artwork

THEORY

1. List five types of saws.

2. Provide three examples of boring tools.

**WEEK FOUR**

**TOPIC: METAL WORK- HAND TOOL-Marking out and measuring tools**

Metal is a fundamental material in technology used for constructing and fabricating various devices. To work with metal effectively, whether for construction or manufacturing, you require the right tools. These tools can be categorized into hand tools or machine tools.

I. MARKING OUT TOOLS:

Marking out tools are hand instruments used for creating precise lines on metal surfaces, checking alignment, and indicating specific points or positions on a workpiece. Common marking out tools in the workshop include:

1. Surface Plate: A precision piece of equipment featuring a high-grade finished flat surface used for placing workpieces for marking out and testing surface flatness. To maintain its accuracy:

- Cover the surface after use to keep it clean.

- Avoid hammering it.

- Prevent scratching or deforming the surface.

2. Surface Table: Larger than a surface plate, this table supports more substantial workpieces for easier and more accurate marking out. It is typically made of cast iron and possesses a high-grade surface.

3. Scriber: Often referred to as the metal worker's pencil, the scriber is used for hand-marking lines. It is employed in conjunction with straight edges like steel rules, try squares, or box rules. Scribers are crafted from high carbon steel or stainless steel, which is hardened and tempered, and they come in various sizes.

4. Divider: Dividers are two-legged steel tools used for scribing arcs, curves, and for setting off distances. They are available in different sizes and may feature spring-loading with a fine adjusting screw or a fixed head.

5. Punches: Punches are made from medium or high carbon steel and include the dot punch and center punch.

- Dot Punch: Used to create spaced indentations along scribed lines to make them more visible while working. It typically has a 60-degree conical end.

- Center Punch: Employed to create a heavy conical dent at the precise location where a hole will be drilled in a workpiece, preventing the drill from deviating from the intended hole location. It usually has a 90-degree conical end.

6. Try Square: This precision tool is used to test the squareness of surfaces and mark out lines at right angles to given edges. The stock and blade, its main components, form a 90-degree angle with each other.

7. Box Square: Used for making parallel lines on round bars, it is made from medium carbon steel (hardened and tempered) and includes graduations on its body for marking off dimensions during the marking out process.

EVALUATION:

1. Define marking out tools.

2. Enumerate eight marking out tools and elucidate their uses.

II. MEASURING TOOLS:

Measuring tools are essential for determining lengths, widths, thicknesses, or sizes of metal components. Measurements are typically taken during the marking out process. Common measuring tools include:

1. Steel Rule: Constructed from carbon steel or stainless steel, steel rules are graduated in millimeters and centimeters. To take precise measurements, place the steel rule on its edge to touch the workpiece, ensuring an accurate reading from the center of the division lines.

2. Caliper: Calipers are utilized for measuring diameters, widths, and thicknesses of objects. They come in various types:

- External Caliper: Measures dimensions from the outside of objects.

- Internal Caliper: Measures dimensions from the inside of objects.

- Odd-leg Caliper: Measures dimensions from the middle of objects to the outside.

3. Combination Sets: These measuring instruments consist of three heads:

- The centre square: Used for determining the center of round shafts or holes.

- The square head: Measures and sets out 90-degree and 45-degree angular surfaces.

- The protractor head: Functions both as a marking out tool and a measuring tool, graduated between 0 and 180 degrees.

4. Micrometer: Precisely measures small object diameters in millimeters. Available as internal and external micrometers, they provide high-precision measurements.

5. Vernier Caliper: Suitable for accurate measurements, vernier calipers are used for both external and internal measurements of objects in centimeters.

6. Depth Gauge: Measures the depth of holes, similar to an outside micrometer.

7. Height Gauge: Performs two functions:

- Determines the height of components.

- Marks out dimensions.

GENERAL EVALUATION:

1. Define measuring tools.

2. List five measuring tools and explain their applications.

3. Define marking out tools.

4. Enumerate eight marking out tools and clarify their uses.

WEEKEND ASSIGNMENT:

1. Which of the following is not a material used in technology?

(a) Metal and Wood

(b) Plastic and Rubber

(c) Ceramic

(d) Internet

2. Among the following, which are marking out tools?

(a) Surface plate

(b) Scriber

(c) Hammer

(d) Try square

3. Which of the following are measuring tools?

(a) Steel rule

(b) Scriber

(c) Caliper

(d) Micrometer

4. What is referred to as the "metal worker's pencil"?

(a) Surface plate

(b) Scriber

(c) Hammer

(d) Try square

5. Which tool is used to determine the center of round shafts and holes?

(a) Try square

(b) Centre square

(c) Set square

(d) Diameter square

THEORY:

1. Define the following hand tools: (i) marking out tools, (ii) measuring tools.

2. List (i) eight marking out tools, and (ii) five measuring tools, explaining their purposes.

**WEEK FIVE**

**TOPIC: METAL WORK- HAND TOOL- Cutting and Driving tools**

big jobs when marking out.

Pliers

Pliers are useful general-purpose holding tools.

Types of pliers:

1. Long nose pliers

2. Flat nose pliers

3. Round nose pliers

Evaluation:

1. Outline the procedure for using clamps.

2. Mention four types of pliers.

GENERAL CARE OF HAND TOOLS

Metalwork hand tools need careful handling during and after use. They should also be kept or stored properly to remain accurate and serve well in the future. The following guidelines will help you care for workshop tools:

1. Use the right tool for the right operation. Using the wrong tool can damage the tool, the workpiece, or even cause injury.

2. After use, clean the tool before storing it away. Removing dirt, debris, and any remaining materials will help maintain the tool's performance and longevity.

3. Store tools in an orderly manner. Use racks or designated storage areas for drills, chisels, spanners, and other tools. Organizing tools makes it easy to find and access them when needed.

4. Store tools away from pathways to prevent obstruction to free movement within the workshop.

5. Avoid keeping tools in damp places as moisture can cause them to rust and become damaged over time.

GENERAL EVALUATION

1. State five general care guidelines for hand tools.

2. State three types of work holding devices.

3. State and explain four types of vices.

4. State three types of pliers and their uses.

WEEKEND ASSIGNMENT

1. The devices used to keep jobs in the workshop firm to the workbench are called \_\_\_\_\_\_\_\_\_\_\_. (a) cutting tools (b) driving tools (c) holding tools (d) marking out tools

2. The following are examples of holding devices except \_\_\_\_\_\_\_\_\_\_\_. (a) vices (b) clamps (c) pliers (d) odd leg caliper

3. The type of vice commonly used on drilling, milling, and shaping machines is called \_\_\_\_\_\_\_\_\_\_\_. (a) bench (b) machine (c) leg (d) hand

4. Which of the following is not a type of clamp? (a) Drill (b) Pliers (c) Toolmaker’s (d) G-Clamp

5. Which of the following is used for holding metal in drilling operations and securing jobs on angle plates for marking out? (a) Drill (b) Pliers (c) Toolmaker’s (d) G-Clamp

THEORY

1. Define the following hand tools: (i) Cutting tools (ii) Driving tools

2. State four types of cutting tools and three types of driving tools.

**WEEK SEVEN**

**TOPIC: MAINTENANCE**

Definition of Maintenance

Maintenance, in the realm of engineering and machinery, refers to the essential tasks and activities that must be carried out regularly to ensure the proper functioning and optimal condition of industrial plants and equipment. It is important to note that equipment breakdowns typically occur due to inadequate or insufficient maintenance.

Types of Maintenance

1. Predictive Maintenance: Predictive maintenance represents a modern approach that employs advanced technology and sensors to anticipate and forecast potential machine failures or breakdowns. By analyzing data and performance metrics, this method enables proactive maintenance actions to be taken before any significant issues arise.

2. Preventive Maintenance: Preventive maintenance is a proactive strategy that involves scheduled and routine maintenance tasks performed on equipment and machinery, even before any apparent need arises. This approach aims to maximize the lifespan of the equipment, reduce unexpected failures, and ensure consistent operational efficiency. It begins from the moment the equipment is first installed and continues throughout its operational life.

3. Corrective Maintenance: Corrective maintenance, on the other hand, is a reactive approach undertaken when equipment or machinery has already broken down. In such cases, repairs are carried out to restore functionality. While not as ideal as preventive or predictive maintenance, corrective maintenance is a necessary measure when unexpected failures occur.

Evaluation

1. Define maintenance.

2. Identify and describe three types of maintenance.

General Evaluation

1. State three common uses of ceramic and rubber materials.

2. List five examples of woodworking bench fittings.

Weekend Assignment

1. Define maintenance.

2. Identify and describe three types of maintenance.

3. Enumerate eight distinct forms of energy.

**WEEK EIGHT**

**TOPIC: BASIC COMPONENTS OF ELECTRIC CIRCUI**

Electric Circuits

An electric circuit can be defined as a designated pathway specifically engineered to facilitate the efficient flow of electric current. These circuits serve the fundamental purpose of converting electric current into various practical applications, including but not limited to lighting and heating. Within an electric circuit, there exists a comprehensive integration of components that both regulate and quantify the flow of current and energy throughout the entire process.

Now, I'll elaborate on the basic components of an electric circuit and the typical arrangement of such circuits.

Basic Components of Electric Circuit

Electric circuits consist of several essential components, each with its unique function. Here are the key components:

1. Voltage Source: The voltage source provides the electromotive force (EMF) required to drive the electric current through the circuit. Common examples include batteries and power supplies.

2. Conductors: Conductors are materials with excellent electrical conductivity that enable the flow of electrons. Copper and aluminum wires are frequently used as conductors.

3. Switches: Switches serve as control devices that can either open or close the circuit, allowing you to control the flow of current.

4. Resistors: Resistors are components designed to impede the flow of current. They are used to regulate the amount of current in the circuit and are often employed for safety and functional purposes.

5. Capacitors: Capacitors store electrical charge and can release it when needed. They are often used in timing circuits and as energy storage devices.

6. Inductors: Inductors are coils of wire that resist changes in current flow. They are used in various applications, including inductance-based sensors and filters.

7. Diodes: Diodes allow current to flow in one direction only, blocking it in the reverse direction. They are crucial in rectifying AC (alternating current) to DC (direct current) in power supplies.

8. Loads: Loads are devices or components within the circuit that consume electrical energy to perform specific tasks. Examples include light bulbs, heaters, and motors.

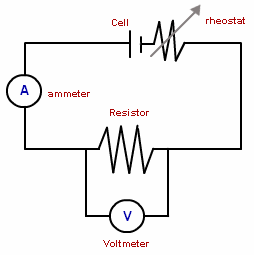
**Arrangement of Electric Circuit**

The arrangement of an electric circuit is a critical aspect of its design, impacting its functionality and safety. Common circuit configurations include:

- Series Circuit: Components are connected end-to-end in a single pathway. In a series circuit, the same current flows through all components, and the voltage is divided among them.

- Parallel Circuit: Components are connected in multiple pathways, providing separate current paths for each component. In a parallel circuit, voltage remains consistent across all components, while the current varies.

- Combination Circuit: Combination circuits combine both series and parallel elements, allowing for more complex and versatile circuit designs.

Understanding these fundamental components and their arrangements is essential for designing and troubleshooting electric circuits for various applications.

Simple electric circuit

Basic Components of an Electric Circuit

In the realm of electric circuits, there exist fundamental components that play pivotal roles in facilitating the flow of electric current. Let's delve into these components and their significance:

1. Cell or Battery: Cells or batteries are the driving force behind the movement of free electrons within the circuit. When one coulomb of charge traverses from one point to another in a conductor, it entails the completion of work, known as potential difference (P.D). This potential difference is quantified in volts (V) and is measured using a device called a voltmeter (V).

2. Ammeter: To quantify the current flow within a circuit, an ammeter (A) is employed. Current, symbolized by 'I,' is measured in Amperes (A). The ammeter serves as the instrument to gauge this vital parameter.

3. Resistance and Resistors: Resistors are components designed to impede the unhindered flow of electrons within the circuit. The magnitude of this resistance (R) is gauged in Ohms (Ω) using an Ohmmeter.

4. Electromotive Force (E.M.F): E.M.F, represented as 'V,' is the impelling force behind the movement of electrons within the circuit. This force can be quantified in voltage (V) using a voltmeter (V). E.M.F essentially propels the current around the electric circuit.

Sources of E.M.F

1. Dry Cell or Primary Cell: Dry cells, often generating 1.5 volts each, serve as a source of electromotive force in various portable devices.

2. Wet Cell or Secondary Cell: Wet cells, producing approximately 12 volts each, are commonly found in applications such as automotive batteries.

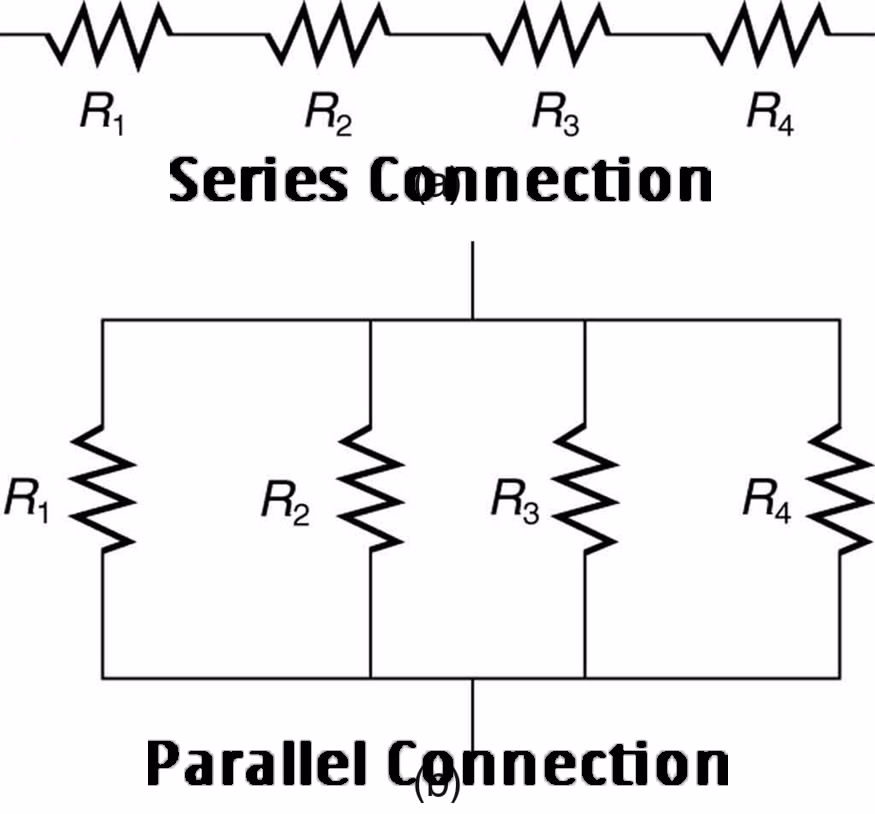
Arrangement of Electric Circuits

Electric circuits can assume different configurations, each with distinct characteristics:

(i) Series Arrangement: In a series arrangement, components are connected end-to-end in a single pathway. This means that the same current flows through all components, while the voltage is distributed across them.

(ii) Parallel Arrangement: In a parallel arrangement, components are interconnected in multiple pathways, offering separate current paths for each component. In this configuration, voltage remains constant across all components, while the current may vary.

(iii) Combination of Series and Parallel Arrangement: More complex circuits can incorporate both series and parallel elements, providing greater flexibility in design and functionality.

Understanding the role and arrangement of these basic components is paramount for comprehending and effectively working with electric circuits in diverse applications.

Parallel Arrangement

EVALUATION QUESTION

1. (a) Define an electric circuit (b) draw a simple electric circuit

2. State the instrument used in measuring (i) potential difference (ii) current

3. Define: (a) potential difference (b) E.M.F (c) state two source of E.M.F

**WEEK NINE AND TEN: VOLTAGE, RESISTANCE, INDUCTANCE, AND CAPACITANCE**

In this segment of our electrical journey, we'll explore essential concepts in the world of electricity, shedding light on voltage (potential difference), resistance, inductors, inductance, and induced current.

**Voltage (Potential Difference)**

Voltage, often referred to as potential difference, is the measure of difference in electric potential between two points within an electric field. It represents the work done when moving a unit electric charge from one point to another in the field. This electrical potential is quantified in volts, with measurement conducted using a voltmeter.

**Resistance**

Resistance symbolized as 'R,' is the inherent opposition encountered by a circuit, component, or substance when the flow of electricity traverses it. It can be likened to the hindrance electricity faces in its path. Resistance is quantified in ohms (Ω), and measurement is facilitated by an ohmmeter.

Inductors

Inductors are components in electrical circuits that possess the remarkable ability to generate an induced voltage in response to changes in current. These devices, often compact coils, resist alterations in circuit current. The magnitude of this opposition is termed inductance. When an electric current courses through a coil, it induces an electromotive force, which is measured in henrys (H). This attribute is the essence of inductance.

**Induced Current**

Induced current is the resulting electromotive force generated within a conductor due to relative motion between conductors and a magnetic field. It's essentially the current induced by the dynamic interaction of magnets with coils, typically occurring in devices like generators and transformers.

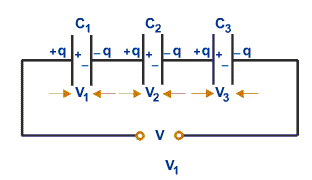
Now, let's evaluate our understanding:

1. Define (a) inductor (b) inductance (c) induced current.

Let's also delve into the definition of a related concept:

**Definition of Capacitor and Capacitance**

A capacitor serves as an electrical device designed for the storage of electrical charges. It exhibits the ability to accumulate and store electrical energy.

I hope this clarifies and enhances your comprehension of these fundamental electrical **concepts.** Capacitor

The capacitance of a capacitor can be defined as the ratio of the electric charge to the potential difference between or across the plates of the capacitor. The charge storing ability of a capacitor is also referred to as capacitance of the capacitor. It is measured in farad (F)

Principle of Operation of a Capacitor

To understand the principle of a capacitor, envision two flat plates, arranged in parallel to each other. These plates can be charged positively or negatively through the application of electrical force, often from a cell connected to points A and B.

Once these plates are charged for a certain duration, the cell is disconnected, yet the plates retain their charges. This setup can be likened to an electrical reservoir or an "electric stone," and this is precisely what a capacitor represents. The plates themselves are typically referred to as electrodes, while the space separating them is termed the dielectric, which functions as an insulator. Depending on the required capacitance value, the plates can be separated by materials like air, mica, paper, or rubber.

**Types of Capacitors**

There exist various types of capacitors, each tailored for specific applications:

1. Air Capacitor: This capacitor employs air as its dielectric material and is commonly used in electrical circuits. It typically consists of two aluminum plates, with one being fixed, while the other can be adjusted.

2. Paper Capacitor: Comprising a thin strip of paraffin-waxed paper rolled between layers of thin aluminum foil, this capacitor is designed for specific applications.

3. Mica Capacitor: This capacitor employs solid mica as its dielectric material, making it suitable for scenarios requiring precision capacitors.

4.Electrolytic Capacitor: These capacitors employ electrolytes as part of their construction, which allows them to store larger charges. They are often used in situations where a high capacitance value is necessary.

5. Polyethylene Capacitor: Utilizing polyethylene as the dielectric material, these capacitors serve specific applications in electronic circuits.

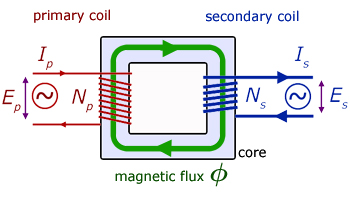
These plates and dielectric materials are usually rolled into a compact structure and enclosed within plastic, cardboard, or metal casings. Capacitors are also categorized as either 'fixed' or 'variable' depending on their intended function.

Capacitors find numerous applications in electronic circuits, including but not limited to motor vehicles, air conditioning systems, and more.

**Transformers**

A transformer is a device utilized to transfer electrical energy from one circuit to another through the process of electromagnetic induction. A typical transformer comprises the primary winding (labeled as A), the secondary winding (labeled as B), and a soft iron core that serves to minimize flux leakage.

One of the primary functions of a transformer is to step up or step down the voltage supplied to it. For instance, in Nigeria, a step-down transformer is crucial to reduce the voltage from 220V to 110V, ensuring compatibility with specific devices.

I hope this revised explanation clarifies these concepts and enhances your understanding of them.

**Principle of Operation and Transformer Windings**

For instance, when an appliance requires a voltage of 440 volts, the primary windings can consist of 20 turns, and correspondingly, the secondary windings must also have 20 turns. This relationship arises from the fact that, in general, the output voltage concerning the input voltage is proportional to the ratio between the number of turns in the secondary (Ns) and primary (Np) windings. This relationship is expressed as:

\[ \text{Voltage in primary (Ep)} = \text{Number of turns in the primary (Np)} \]

\[ \text{Voltage in secondary (Es)} = \text{Number of turns in the secondary (Ns)} \]

Worked Example

Let's work through an example:

Given data:

Ep = 10 volts

Np = 20 turns

Ns = 100 turns

To find Es (the secondary voltage), we use the following formula:

\[ Es = \frac{Ep \times Ns}{Np} \]

Substituting the values:

\[ Es = \frac{10 \times 100}{20} \]

\[ Es = 50 \text{ volts} \]

This means that the secondary voltage is 50 volts.

Transformers serve various purposes, from stepping down voltages for low-voltage household appliances using small transformers to large commercial transformers at substations that step high voltages from sources like the Kanji Dam down to low voltages suitable for residential houses.

Evaluation

1. Define (a) capacitor (b) the capacitance of a capacitor (c) Electrode.

2. Explain the principle of operation of a capacitor.

General Evaluation

1. Mention three (3) types of scale drawing.

2. State and give examples of types of wood.

Weekend Assignment

1. The gap between the capacitor's plates is called \_\_\_ (a) electric (b) dielectric (c) capacitance (d) inductance.

2. The above symbol represents \_\_\_ (a) cell (b) switch (c) capacitor (d) resistor.

3. Capacitors cannot be used in one of the following: (a) air-conduction (b) motor vehicle (c) boiling ring (d) television.

4. The SI unit of inductance is \_\_\_ (a) voltage (b) ampere (c) Henry (d) ohms.

5. \_\_\_ is a circuit element that has the ability to produce an induced voltage in response to changing current: (a) resistor (b) inductor (c) capacitor (d) cell.

Theory

1. Define (a) Potential Difference (b) Inductance (c) Resistance.

2. What is a capacitor? State the types of capacitors.