Answer

A. Synchronous motor is not self starting : Refer Q. 4.33, Page 4–40D, Unit-4.

B. Application of synchronous motor : Refer Q. 4.33, Page 4–40D, Unit-4.

C. Advantages of synchronous motor :

1. Constant speed operation.
2. Higher efficiency, especially in the low speed unity power factor range.
3. Capability of being operated under a wide range of power factor both lagging and leading.

D. Disadvantages of synchronous motor :

1. Cost per kW output is higher than that of induction motor.
2. It requires DC excitation which must be supplied from external source.
3. It has a tendency to hunt.
4. It cannot be started under load. Its starting torque is zero.
5. Collector rings and brushes are required.

Que 4.36. Write a short note on synchronous condenser.

AKTU 2013-14(Sem-2), Marks 05

Answer

1. Synchronous condenser is also known as synchronous compensator or synchronous phase modifier.
2. A synchronous condenser is a synchronous motor running without a mechanical load. It can generate or absorb reactive volt-ampere (VAR) by varying the excitation of its field winding.
3. It can be made to take a leading current with over-excitation of its field winding. In such a case it delivers inductive or absorbs capacitive Volt-ampere reactive.
4. If it is in under excited condition, it draws the lagging current and, therefore, supplies capacitive or absorbs inductive volt-ampere reactive. Thus, a current drawn by a synchronous capacitor or condenser can be varied from lagging to leading smoothly by varying its excitation.
5. When the motor power factor is unity, the DC excitation is said to be normal. Over-excitation causes the motor to operate at a leading power factor.
6. Under excitation causes it to operate at a lagging power factor. When the motor is operated at no load with over-excitation, it takes a current that leads the voltage by nearly 90 degrees.
7. Thus, it behaves like a capacitor and under such operating conditions, the synchronous motor is called a synchronous capacitor.
8. Since a synchronous condenser behaves like a variable inductor or a variable capacitor, it is used in power transmission systems to regulate line voltage.

☺☺☺

5 UNIT

Electrical Installation

PART-1

Components of LT Switchgear : Switch Fuse Unit (SFU), MCB, ELCB, MCCB.

CONCEPT OUTLINE : PART-1

- Electrical circuit breaker is a kind of switching device which can be activated automatically as well as manually to control and protect an electrical power system respectively.
- MCB is an electromechanical device which guards an electrical circuit from an over current.
- The MCCB is used to control electric energy in distribution.
- The ELCB is used to protect the circuit from the electrical leakage.
- A RCCB is current sensing equipment used to guard a low voltage circuit from the fault.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 5.1. Write a short note on switch fuse element (SFU).

Answer

1. SFU means Switched Fuse Unit. It has one switch unit and one fuse unit.
2. When we operate the breaker, the contacts will get close through switch and then the supply will pass through the fuse unit to the output.
3. Whereas in Fuse Switch Unit there is no separate switch and fuse unit. There is only fuse unit which act itself as a switch. When we operate, the fuse unit will close the input and output of the breaker.
4. SFU has been used to trip the circuit, particularly for high capacity tripping.

Que 5.2. Discuss construction and working principle of MCB (Miniature Circuit Breaker).

Answer

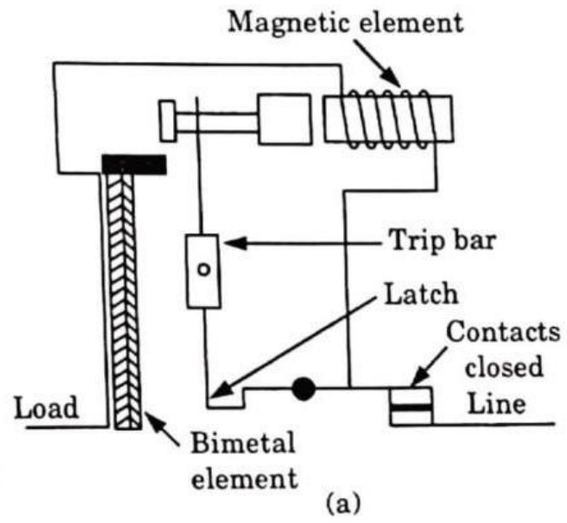
A. MCB : Miniature circuit breakers known as MCBs, are mechanically operated switches cum electro-mechanically operated automatic circuit protection devices. They are used to interrupt a circuit during overload and short circuits.

B. Construction of MCB :

1. **External casing :** External casing holds all the internal components firm and protects them from dust. It is made of insulating materials such as plastic or ceramics etc.
2. **Contacts :** A pair of contacts can be found inside an MCB. One of them is fixed and other is movable.
3. **Knob :** MCBs can be turned ON and OFF using this knob.
4. **Latch :** A latch arrangement is made inside MCBs to hold the contacts under spring tension at ON position.
5. **Bimetallic strip :** Bimetallic strip offers delayed overload protection by sensing prolonged flow of current greater than its rated current.
6. **Solenoid :** Solenoid offers instantaneous protection against short circuit by releasing the mechanical latch

C. Working principle of MCBs :

1. In the case of overloads, a current more than the rated current is driven through the MCB. As the current flows through the bimetallic strip, it gets heated up and deflects by bending and releases the mechanical latch.



(a)

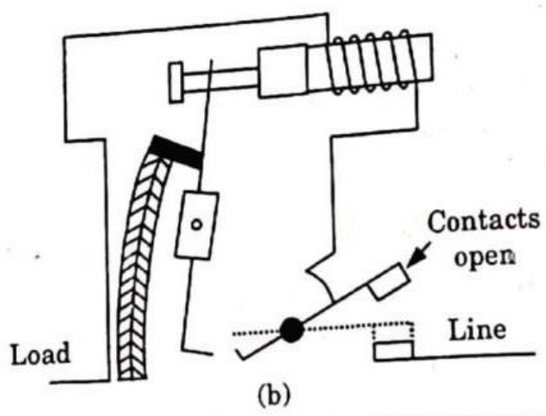


Fig. 5.2.1. Magnetic circuit breaker trip latch operation : (a) normal; (b) overcurrent condition.

2. Deflection time of bimetallic strip depends on the amount of current flowing through the strip. Higher the current faster will be the deflection of bimetallic stip.
3. During short circuits, a transient current flowing through the solenoid forces the plunger towards the latch. This action instantaneously releases the mechanical latch and opens the contacts immediately.

Que 5.3. What are the functions of MCB ? Also give its applications and advantages over fuses.

Answer

A. Functions :

1. **Switching :** Miniature circuit breakers can be switched ON and OFF manually.
2. **Overcurrent protection :** When an equipment is overloaded it draws more current from the source. This current flows through the bimetallic strip and heats it up. Bimetallic strip that deforms on heating will knock down the latch, thereby opening the contact and isolate the equipment from the supply.

B. Applications : MCBs are used in the protection of lights, refrigerators, air conditioners etc. as an alternative for fuses.

C. Advantages of MCBs over fuses :

1. It can act faster than fuses during short circuits.
2. MCBs can offer better overload protection than fuses.
3. MCBs can be reset after the clearance of fault. But fuses needs to be rewired or replaced.
4. Safer interruption of short circuit current and arc quenching.
5. Knob makes operation of MCBs much easier than a fuse.

6. MCBs can be turned off whenever we want. Therefore, Circuit isolation during maintenance is much easier compared to fuses.

Que 5.4. Discuss working principle of different types of ELCB (Earth leakage circuit breaker).

Answer

A. ELCB : An earth leakage circuit breaker (ELCB) detects the earth leakage current and makes the power supply OFF by opening the associated circuit breaker.

B. Types of earth leakage circuit breaker :

i. Voltage earth leakage circuit breaker :

1. In this breaker, one terminal of the relay coil is connected to the metal body of the equipment to be protected against earth leakage and other terminal is connected to the earth directly.
2. If any insulation failure occurs or live phase wire touches the metal body, of the equipment, there must be a voltage difference appears across the terminal of the coil connected to the equipment body and earth. This voltage difference produces a current to flow through the relay coil.

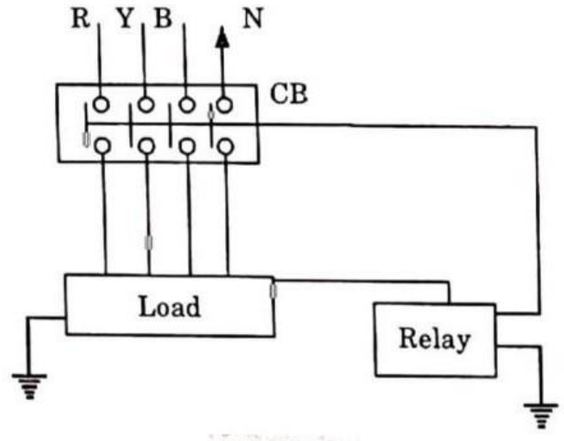


Fig. 5.4.1.

3. If the voltage difference crosses a predetermined limit, the current through the relay becomes sufficient to actuate the relay for tripping the associated circuit breaker to disconnect the power supply to the equipment.

ii. Current ELCB or RCCB (Residual Current Circuit Breaker) :

1. Here one CT core is energized from both phase wire and neutral wire.
2. In this, the polarity of the phase winding and neutral winding on the core is so chosen that, in normal condition, mmf of one winding opposes that of another.
3. In normal operating conditions the current goes through the phase wire will be returned via neutral wire if there is no leakage in between.

4. As both currents are same, the resultant mmf produced by these two currents is also zero-ideally.
5. The relay coil is connected with another third winding wound on the CT core as secondary. The terminals of this winding are connected to a relay system.
6. In normal operating condition there would not be any current circulating in the third winding as here is no flux in the core due to equal phase and neutral current.
7. When any earth leakage occurs in the equipment, there may be part of phase current passes to the earth, through the leakage path instead of returning via metal wire.
8. Hence the magnitude of the neutral current passing through the RCCB is not equal to phase current passing through it.

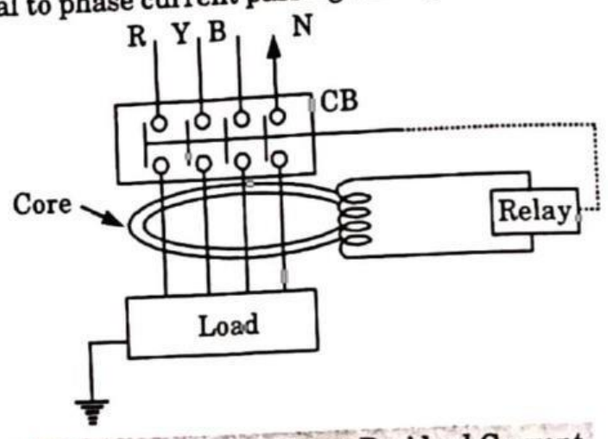


Fig. 5.4.2. Three Phase Residual Current Circuit Breaker or Current ELCB.

9. When this difference crosses a predetermined value, the current in the third secondary winding of the core becomes sufficiently high to actuate the electromagnetic relay attached to it.
10. This relay causes tripping of the associated circuit breaker to disconnect the power supply to the equipment under protection.

Que 5.5. Write a short note on moulded case circuit breaker (MCCB).

Answer

A. MCCB :

1. Moulded Case Circuit Breakers (MCCB) are electromechanical devices which protect a circuit from overcurrent and short circuit.
2. They provide overcurrent and short circuit protection for circuits ranging from 63 amps up to 3000 amps.
3. Their primary functions are to provide a means to manually open a circuit and automatically open a circuit under overload or short circuit conditions. The overcurrent, in an electrical circuit, may result from short circuit, overload or faulty design.

4. MCCB is an alternative to a fuse since it does not require replacement once an overload is detected. Unlike fuse, an MCCB can be easily reset after a fault and offers improved operational safety and convenience without incurring operating cost.

B. Characteristics of MCCB :

1. The range of rated current is up to 1000 amperes.
2. Trip current may be adjusted.
3. Thermal magnetic operation.

PART-2

Types of Wires and Cables, Importance of Earthing.

CONCEPT OUTLINE : PART-2

- Electrical wire is used to carry electrical current from the power source to the end user device.
- A cable is an assembly of two or more electrical conductor, usually held together with an overall sheath. The assembly is used for transmission of electrical power.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 5.6. Discuss different types of wires.

Answer

A. Electrical wire : Electrical wire is used to carry electrical current from the power source to the end user device.

B. Types of wire :

1. Triplex wires :

i. Triplex wires are usually used in single-phase service drop conductors, between the power pole and weather heads.

ii. They are composed of two insulated aluminium wires wrapped with a third bare wire which is used as a common neutral. The neutral is usually of a smaller gauge and grounded at both the electric meter and the transformer.

2. Main feeder wires : Main power feeder wires are the wires that connect the service weather head to the house. They are made with stranded or solid THHN (*T* = Thermoplastic Insulation, *HH* = High heat resistance, *N* = Nylon coating) wire.

3. **Panel feed wires :** Panel feed cables are generally black insulated THHN wire. These are used to power the main junction box and the circuit breaker panels.

4. **Non-metallic sheathed wires :**

i. Non-metallic sheath wire is used in homes and has 2-3 conductors, each with plastic insulation, and a bare ground wire.

ii. The individual wires are covered with another layer of non-metallic sheathing. Since it is relatively cheaper and available in ratings for 15, 20 and 25 amps, this type is preferred for in-house wiring.

5. **Single strand wires :** Single strand wire also uses THHN wire, though there are other variants. Each wire is separate and multiple wires can be drawn together through a pipe easily.

Que 5.7. Discuss general construction of cable.

Answer

The Fig. 5.7.1 shows the general construction of a cable. Its various parts are :

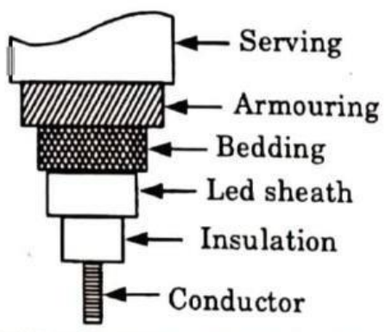


Fig. 5.7.1. Construction of a cable.

Various parts of cable :

1. **Conductor or core :**

i. This section consists of single conductor or more than one conductor. The conductors are also called cores. A cable with three conductors is called three core cable.

ii. The conductors used are aluminium or annealed copper. The conductors are stranded in order to provide flexibility to the cable.

2. **Insulation :** Each conductor or core is covered by insulation of proper thickness. The commonly used insulating materials are varnished cambric, vulcanized bitume mpregnated paper.

3. **Metallic sheath :** The insulated conductors are covered by lead sheath or aluminium sheath. This provides the mechanical protection but mainly restricts moisture and other gases to reach to the insulation.

4. **Bedding :**

i. The metallic sheath is covered by another layer called bedding. The bedding consists of paper tape compounded with a fibrous material lime jute strands or hessian tape.

ii. The purpose of bedding is to protect the metallic sheath from corrosion and from mechanical injury resulting due to armouring.

5. **Armouring :** This layer consists of the layers of galvanized steel which provide protection to the cable from the mechanical injury.

6. **Serving :** The last layer above the armouring is serving. It is a layer of fibrous material like jute cloth which protects the armouring from the atmospheric conductions.

Que 5.8. Discuss in brief about the different types of cables.

Answer

A. Cable :

1. A cable is an assembly of two or more electrical conductors, usually held together with an overall sheath. The assembly is used to for transmission of electrical power.

2. The type of a cable is basically based on the voltage level for which it is manufactured and the material used for the insulation such as paper cotton; rubber etc.

B. Types of cable :

1. **Low tension cable (LT cable) :**

i. These are used for the voltage levels upto 6.6 kV.

ii. The paper is used as insulation in these cables. Some time resin is also used which increases the viscosity and helps to prevent drainage.

2. **Medium and high tension cables :**

i. The three phase medium and HT cables are three core cable. For voltage upto 66 kV the three core cable, *i.e.*, multicore cables are used.

ii. These cables are classified as :

a. **Belted cables :**

i. These are used for the voltage level upto 11 kV.

ii. The cores are not circular in shape. The cores are insulated from each other by use of impregnated paper.

b. **Screened type cables :** These cables are used for the voltage levels of 22 kV and 33 kV.

3. **Super tension (ST) cables :**

i. The ST cables are used for 132 kV to 275 kV voltage level.

ii. Such cables using oil or gas under pressure are called pressure cables and are of two types :

a. Oil filled cables : In case of oil filled cables, the channels or ducts are provided within or adjacent to the cores, through which oil under pressure is circulated.

b. Gas pressure cables :

1. In case of gas pressure cables an inert gas like nitrogen at high pressure is introduced. The pressure is about 12 to 15 atmospheres.
2. Due to such a high pressure there is a radial compression due to which the ionization is totally eliminated. The working power factor of such cables is also high.

Que 5.9. What is earthing ? Why is it necessary to have earthing in electric network?

Answer

A. Earthing :

1. Earthing (or grounding) is the process of transferring the immediate discharge of electricity directly to the earth plate, by means of low resistance electrical cables or wires.
2. The earthing is done by connecting the non-current carrying part of the equipment or neutral of supply system to the ground.

B. Necessity of earthing :

1. It keeps people safe by preventing electric shocks.
2. It prevents damage to electrical appliances and devices by preventing excessive current from running through the circuit.
3. It prevents the risk of fire that could otherwise be caused by current leakage.
4. It provides the easiest path to the flow of short circuit current even after the failure of the insulation.

Que 5.10. Why proper earthing is necessary ? What is the importance of earth's resistance value ?

AKTU 2014-15(Sem-1), Marks 05

Answer

A. Necessity of earthing : Refer Q. 5.9, Page 5–10D, Unit-5.

B. Importance of earth's resistance value :

1. The earth resistance is the resistance offered by the soil and the electrode to the flow of earth leakage current which will flow in case of earth fault only.
2. Earth resistance value is directly proportional to soil resistivity value.

3. Soil resistivity directly affects the design of a grounding system.
4. When designing an extensive grounding system, it is advisable to locate the area of lowest soil resistivity in order to achieve the most economical grounding installation.
5. The value of soil resistivity should be low, because the earth resistance value is directly proportional to soil resistivity value.
6. The main purpose of keeping the earth resistance to a very low value is to give easy path to the flow of leakage or fault current as soon as it occurs.

Que 5.11. Explain the need of earthing electrical devices. What are the important safety issues ?

AKTU 2013-14(Sem-1), Marks 10

Answer

A. Necessity of earthing : Refer Q, 5.9, Page 5–10D, Unit-5.

B. Important safety issues :

1. Inspect tools, power cords, and electrical fittings for damage or wear prior to each use. Repair or replace damaged equipment immediately.
2. Use cords or equipment that is rated for the level of amperage or wattage.
3. Always use the correct size fuse. Replacing a fuse with one of a larger size can cause excessive currents in the wiring and possibly start a fire.
4. Be aware that unusually warm or hot outlets may be a sign that unsafe wiring conditions exists.
5. Risk of electric shock is greater in areas that are wet or damp. Install Ground Fault Circuit Interrupters (GFCIs) as they will interrupt the electrical circuit before a current sufficient to cause death or serious injury occurs.
6. Do not block access to circuit breakers or fuse bodies.

Que 5.12. Write detailed note on importance of electrical safety issues.

AKTU 2014-15(Sem-1), Marks 05

Answer

1. Electrical hazards are not readily visible. Even a trained eye might not identify an electrical hazard. An electrical hazard can be detected only by recognizing and observing indicators.
2. Similarly, contact with an exposed energized conductor or circuit part can cause a major injury or perhaps cause no injury at all.

3. Understanding electrical hazards and being able to identify such hazards can reduce the risks associated with electrical installations. Knowledge about electrical safety can help everyone to live and work safely around electricity.

Important safety issues : Refer Q. 5.11, Page 5–11D, Unit-5.

Que 5.13. Why earthing is needed in an electrical system ? Enlist the various types of earthing system.

AKTU 2013-14(Sem-2), Marks 10

Answer

A. Necessity of earthing : Refer Q. 5.9, Page 5–10D, Unit-5.

B. Types of earthing system :

i. Plate earthing :

1. In this type of earthing plate either of copper or of G.I. (galvanized iron) is buried into the ground at a depth of not less than 3 meter from ground level.
2. The earth plate is embedded in alternative layer of coke and salts for a minimum thickness of about 15 cm.
3. The earth wire (copper wire for copper plate and G.I. wire for plate earthing) is securely bolted to an earth plate with the help of bolt nut and washer made of copper , in case of copper plate earthing and of G.I. in case of G.I. plate earthing.

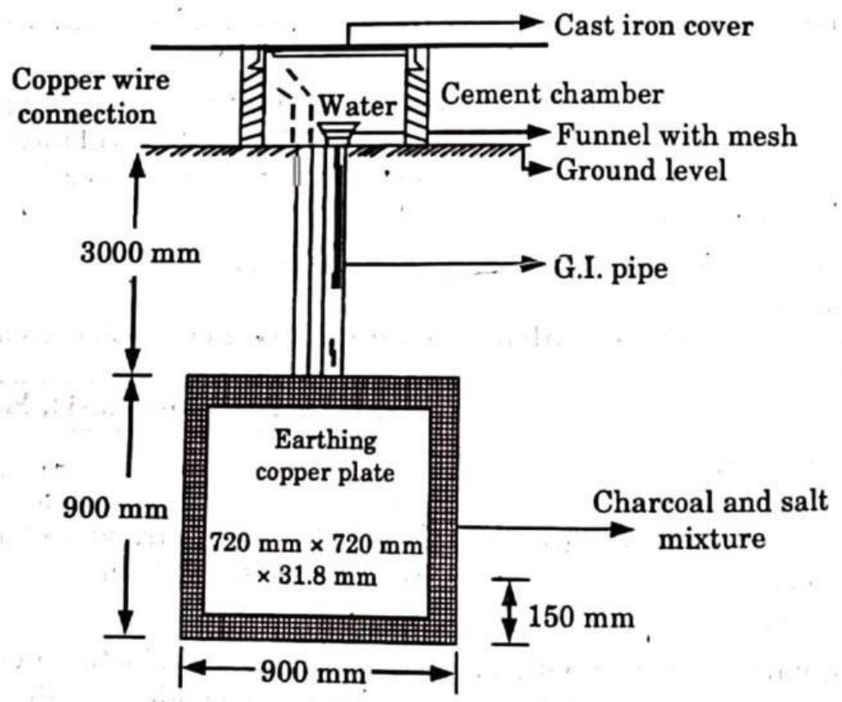


Fig. 5.13.1. Plate earthing.

ii. Pipe earthing :

1. Pipe earthing is best form of earthing and it is cheap also. In this system of earthing a G.I. pipe of 38 mm dia and 2 meters length is embedded vertically in ground to work as earth electrode but the depth depend upon the soil conditions.
2. Also the wire is embedded upto the wet soil.
3. The earth wires are fastened to the top section of the pipe with nut and bolts.
4. The pit area around the G.I. pipe is filled with salt and coal mixture for improving the soil conditions and efficiency of the earthing system.

iii. Rod earthing :

1. In this system of earthing 12.5 mm diameter solid rods of copper, 16 mm diameter solid rod of G.I. or steel or hollow section of 25 mm G.I. pipe of length not less than 3 meters are driven vertically into the earth.
2. In order to increase the embedded length of electrode under the ground, which is some time necessary to reduce the earth resistance to desired value more than one rod section are hammered one above the other.
3. This system of earthing is suitable for areas which are sandy in character.
4. This system of earthing is very cheap.

iv. Strip or wire earthing :

1. In this system of earthing strip electrode of cross section not less than 25 mm into 1.6 mm of copper or 25 mm × 4 mm of G.I. or steel are buried in horizontal trenches of minimum depth of 0.5 m.
2. If round conductor are used their cross sectional area shall not be smaller than three if copper is used and 6 mm^2 if G.I. or steel is used.
3. The length of buried conductor shall be sufficient to give the required earth resistance (about 0.5 Ω to 1.5 Ω).
4. It shall however be not less than 15 m.
5. The electrode shall be as widely distributed as possible in a single straight or circular trenches radiating from a point
6. This type of earthing is used in rocky soil earth bed because at such places excavation work for plate earthing is difficult.

PART-3

Types of Batteries, Important Characteristics for Batteries, Elementary Calculations for Energy Consumption and Savings, Battery Backup.

CONCEPT OUTLINE : PART-3

- **Types of battery :**

1. **Primary battery :** A primary battery is a disposable kind of battery. Once used, it cannot be recharged.
2. **Secondary battery :** Secondary batteries are rechargeable batteries. Once discharged, it can be recharged again.

- $\text{Electricity consumption}_{day} = \frac{\text{Meter reading}_{end} - \text{Meter reading}_{start}}{\text{Days in period}}$

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 5.14. Discuss different types of primary battery.

Answer

A. Alkaline batteries :

1. Alkaline batteries are non-rechargeable, high energy density, batteries that have a long life span. It has 1.5 V output.
2. It consists of a zinc anode and manganese dioxide cathode in an alkaline electrolyte (potassium hydroxide).
3. It works with high efficiency even with continuous use, due to low internal resistance.
4. **Applications :** In remote controls, clocks, and radios. The high run time makes alkaline batteries ideal for digital cameras, hand held games, MP3 players etc

B. Zinc-carbon batteries :

1. Zinc-carbon batteries are also known as dry cells (as the nature of electrolyte used in these cells is dry), which come in a composition of a carbon rod (cathode) surrounded by a mixture of carbon powder and manganese dioxide.
2. This whole combination is packed in a zinc container acting as the anode. The electrolyte is a mixture of ammonium chloride and zinc chloride.
3. The typical voltage value is a little less than 1.5 V. These batteries are durable and have longer lives.
4. **Applications :** Used in low power drain applications such as flash lights, remote controls, toys, and table clocks.

C. Mercury batteries :

1. It contains mercuric oxide with manganese dioxide. They are deep discharge batteries and voltage level does not fall below 1.35 V until 5 % energy level is reached.
2. These batteries are less popular because of low output voltage. Furthermore, mercury is toxic and can cause hazards for humans.
3. **Applications :** This battery is useful for photographic light meters and electronic devices.

D. Zinc chloride batteries :

1. This cell is also referred to as a heavy-duty type battery.
2. It is a modified zinc-carbon batteries.
3. It has little chance of liquid leakage because the cell consumes water along with the chemically active materials. The cell is usually dry at the end of its useful life.

E. Silver oxide batteries :

1. This battery consists of a zinc anode, silver oxide cathode, and potassium or sodium hydroxide electrolyte.
2. It is typically available as 1.5 V, miniature button form.
3. **Applications :** Hearing aids, cameras, and watches.

Que 5.15. Discuss different types of battery.

Answer

A. Battery : A battery is a source of electrical energy, which is provided by one or more electrochemical cells of the battery after conversion of stored chemical energy.

B. Types of battery :

1. Primary battery :

i. A primary battery is a disposable kind of battery. Once used, it cannot be recharged.

ii. **Types of primary battery :** Refer Q. 5.14, Page 5–14D, Unit-5.

2. Secondary battery :

i. Secondary batteries are rechargeable batteries. Once empty, it can be recharged again.

ii. **Types of secondary battery :**

a. Lead-Acid Batteries :

1. Lead-acid batteries are the rechargeable kind of batteries. These large, heavy weight batteries find the major application in automobiles as these fulfill the high current requirements of the heavy motors.

2. The composition of lead-acid battery changes in charged and discharged states.
3. A combination of Pb (negative) and PbO_2 (positive) as electrodes with H_2SO_4 as electrolyte in charged form and $PbSO_4$ and water in discharged form.
4. **Applications :**
   i. Application of lead-acid battery is in starting, lightning, and ignition systems of automobiles.
   ii. It can also be used as backup power supply for high end servers, personal computers, telephone exchanges, and in off-grid homes with inverters.

b. Lithium batteries :

1. Lithium batteries are rechargeable (secondary) batteries, where lithium in its pure ion compound form is used.
2. Depending on the design and chemical compounds used, lithium batteries can produce voltages from 1.5 volts to 3.7 volts.
3. The most common type of lithium battery used in consumer applications uses manganese dioxide as cathode and metallic lithium as anode.
4. **Applications :** It is used in portable consumer instruments like calculators, digital diaries, wrist watches and stop watches, toys, and artificial pacemakers.

Que 5.16. Discuss important characteristics of batteries.

Answer

A. Amps/Ampere-hour :

1. It is also known as amperes. This is the rate at which electrons flow in a wire. The units are coulombs per second
2. One ampere-hour is equal to a current of one ampere flowing for one hour.
3. A unit-quantity of electricity used as a measure of the amount of electrical charge that may be obtained from a storage battery before it requires recharging.

B. Capacity : The capacity of a battery is expressed as the total quantity of electricity involved in the electrochemical reaction and is defined in terms of coulombs or ampere-hours (Ah) or the total number of ampere hour or watt-hours that can be withdrawn from a fully charged cell or battery, under specified conditions of discharge, is termed as the capacity of a battery.

C. Power : The power generated by a battery can be calculated as

$$W = VI$$

where, V = Voltage
W = Power
I = Current.

D. Power density :

1. Power density = Energy (E)/time (t)/mass (kg)
   = Energy (qV)/time (t)/mass (kg) of cell
   = Power/mass (units are W/kg)
2. The ratio of the power delivered by battery to its weight, W/kg, is also known as the power density of a battery.

E. Energy density : The energy density is determined by the voltage of the battery and the amount of charge that can be stored, $E = qV$.

F Efficiency :

1. **Voltage efficiency** is described as the ratio of average voltage during discharge to average voltage during recharge under specified conditions.
2. **Watt-hour efficiency** is known as the ratio of watt-hours delivered on discharge of a battery to the watt-hour needed to restore it to its original state under specified conditions of charge and discharge.
3. **Ampere-hour efficiency :** The ratio of the output of a secondary cell or battery, measured in ampere-hours, to the input required to restore the initial state of charge, under specified conditions.

G. Cycle life : For rechargeable batteries, the duration of satisfactory performance, measured in years or in the number of charge/discharge cycles. In practice, end of life is usually considered to be reached when the cell or battery delivers approximately 80 % of the rated ampere-hour capacity.

Que 5.17. Discuss the calculation of following :

A. Electricity consumption per day
B. Electricity consumption per year
C. Energy saving.

Answer

A. Electricity consumption per day :

1. To calculate the daily electricity consumption, the difference between the meter readings is divided by the number of days in the period covered.
2. Mathematically,

$$\text{Electricity consumption}_{\text{day}} = \frac{\text{Meter reading}_{\text{end}} - \text{Meter reading}_{\text{start}}}{\text{Days in period}}$$