

### Unit-3

#### Essay Questions:

1. Explain the construction of DC Motor.
2. Illustrate the working of BLDC motor with a neat sketch.
3. Explain the operating principle and torque equation of a DC motor.
4. Illustrate the working of three phase induction motor with a neat sketch.
5. Illustrate the working of stepper motor with a neat sketch.
6. Describe Fuse/Miniature circuit breaker construction and working.
7. Explain the construction and working principle of Earth Leakage Circuit breaker (ELCB).
8. Explain about earthing and its types.

#### Objective Questions:

**1. Classify major electrical loads with examples in household appliances.**

Ans: **Resistive Load:** Resistive loads include any type of heating element. Best examples are Incandescent lights, toasters, ovens, space heaters, and coffee makers.

**Inductive Load:** Inductive loads provide power to electric motors. Examples are moving parts Fans, vacuum cleaners, dishwashers, washing machines, compressors in refrigerators and air conditioners, and other household items and gadgets.

**Capacitive Load:** Like an inductive load, the capacitive load has both current and voltage waves. The critical difference between a capacitive and inductive load is that the current peaks before the voltage.

Unlike inductive and resistive loads, Capacitive loads will not exist in isolation. Capacitive loads are used in tandem with other electrical loads, particularly inductive loads.

**2. Define slip.**

Ans: The Induction motor will always run at a speed lower than the synchronous speed. The difference between the motor speed and the synchronous speed is called the Slip. It is always expressed in percentage.

$$\text{Slip } S = N_s - N_r$$

$$S = (N_s - N_r) / N_s; \quad \text{Where } N_s = 120f/P$$

$N_s$  = Synchronous speed or speed of the magnetic field

**3. Define Electric shock and mention some precautions to avoid electric shock.**

Ans: When a person comes in contact with a live conductor, directly or indirectly, he gets a shock. The shock may be minor or severe. The severity of shock depends upon the Nature of the current whether AC or DC, Duration of flow of current and Path of current through human body. The following precautions should be taken as preventive measures from electric shock while dealing with electrical equipment fittings or appliances:

1. Never work on live circuit.
2. Always stand on the insulating material, such as rubber mat, wooden board, etc., while switching on the main switch, motor switch, etc.
3. While switching ON the circuit, equipment, etc., ensure that your hands and feet are dry.
4. Avoid working at all those places where your head is liable to touch the live parts.
5. While working with electrical circuits/equipments, never come in contact with the metallic casing, earth conductor, cross arms, etc.
6. While working on the high-voltage circuit, avoid your direct contact with concrete flooring.

7. Never touch the person directly, while rescuing him from electric shock.
8. Consider all conductors as live, till you are not sure.

**4. Define fuse?**

Ans: A short piece of metal wire, inserted in series with the circuit, which melts when predetermined value of current flows through it and breaks the circuit is called a fuse.

**5. What is the function of commutator on DC motor.**

Ans: In DC motors, commutators are used to ensure that the current flow through the rotor windings is always in the same direction and the coil on the rotor is energized with respect to the field coils.

**6. Explain Principle of DC motor.**

Ans: The basic working principle of the DC motor is that whenever a current carrying conductor places in the magnetic field, it experiences a mechanical force.

**7. Explain the principle of Stepper motor.**

Ans: The basic working principle of the stepper motor is the following: By energizing one or more of the stator phases, a magnetic field is generated by the current flowing in the coil and the rotor aligns with this field.

**8. Explain the principle of BLDC motor.**

Ans: The working principle of BLDC motors is based on the interaction between the magnetic fields of the stator and the rotor. The stator produces a rotating magnetic field, which interacts with the permanent magnets on the rotor, producing a torque that causes the rotor to rotate.

**9. What are the types of earthing?**

Ans: Strip earthing  
Earthing through water mains  
Rod earthing  
Pipe earthing  
Plate earthing

**10. Explain the working principle of 3-phase induction motor.**

Ans: When three phase ac supply is connected to 3 phase stator winding. A rotating magnetic field is produced in the air gap, rotating with a speed  $N_s = 120f/P$ . Where  $f$  is the supply frequency and  $P$  is the no. of poles and  $N_s$  is called the synchronous speed in rpm. This rotating magnetic field cuts the stationary rotor conductor and produces an induced voltage in the rotor windings due to the fact that the rotor windings are short circuited, so induced current flows in the rotor winding. According to Lenz's law this current tries to oppose the cause due to which it is produced, since the cause is relative motion between rotating magnetic field and stationary rotor conductor. So rotor starts rotating in same direction in which magnetic field rotate.