Course Name:	**Elements of Electrical and Electronics Engineering**	**Semester:**	**I**
Date of Submission:	**15/ 01/ 2022**	**Batch No:**	G3
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Internal Assessment: 1

Brief Report on

1. Electrical power Generation and distribution systems:

List the Electrical power generation methods in India. Explain using a block diagram how electricity reaches your home from the generating station. Explain in brief the stages of conversion of Voltages and the role of the transformer.

Ans- The various power generation methods in India are-

(Information taken through - Power ministry)

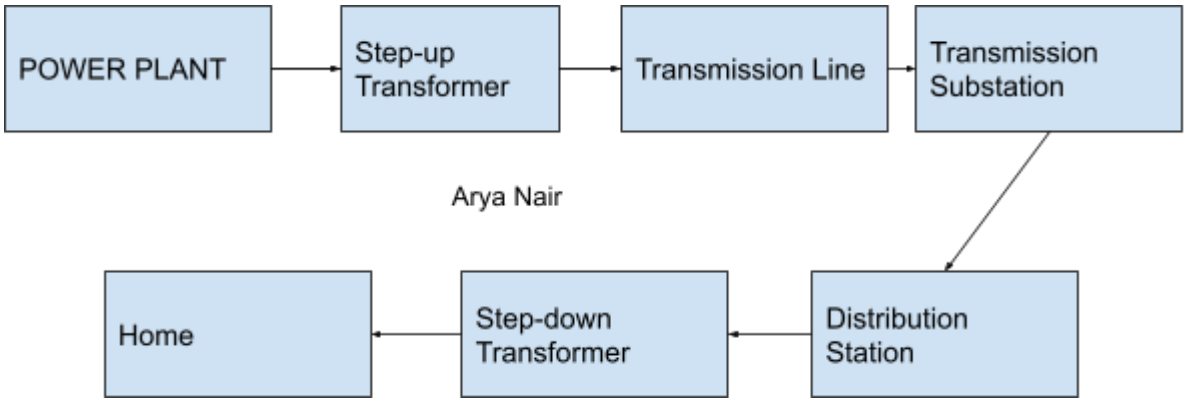
1. Coal
2. Lignite
3. Gas
4. Diesel
5. Hydro
6. Wind
7. Solar
8. BM/Cogen
9. Waste to energy
10. Small Hydropower

Voltage conversion-

When an input voltage is applied to the primary coil, alternating current begins to flow through the primary. When current flows, a changing magnetic field is created in the core of the transformer. When this magnetic field passes through the secondary coil, an alternating voltage is generated in the secondary coil.

The ratio between the actual number of turns in each winding is the key to determining the type of transformer and what the output voltage will be. The ratio of the output voltage to the input voltage is equal to the ratio of the turns of the coil between the two ends of the coil. The output voltage of the transformer is greater than the input voltage if the secondary winding has more turns than the primary winding. The output voltage is boosted and considered a "stepping transformer". If the secondary coil has fewer turns than the primary coil, the output voltage is lower. This is a "step down transformer". The transformer has two windings, primary and secondary. The primary coil is the coil that draws its energy from the source. The secondary coil is the coil that supplies energy at a variable or variable voltage to the load. Usually, these two windings are subdivided into multiple coils to reduce the generation of flux.

Stages of electricity from the generation plant to our homes



When generating electricity at a power plant, it generates electricity at 11kV, but since it is necessary to increase the voltage for long-distance transmission, a transformer is used to raise the voltage to 300kV. Substations carry electricity over long distances before entering a home, then lower the voltage and direct it

to a residential area with electricity suitable for home or office building equipment. Therefore, three step-down transformers are required.
Reduce the voltage three times with a transformer. At a power plant, coal is burned to generate electricity, then a large turbine is turned, and the rotation of the turbine produces mechanical energy, which is converted into electrical energy by various machines. This power is a low voltage of about 11 kV to 33 kV, but since it is necessary to increase the voltage to pass this current over a long distance, use a voltage step-up transformer to step up the voltage to 100 kV 700 kV. .. distance. High voltage should be provided to avoid energy loss. Underground cables are also used in some parts of India even when transmission distances are short. This is known as primary transmission.

When the current reaches the receiving substation, the voltage drops to 33 kV 66 kV and the power is transmitted over the power lines leaving the substation to cities, villages, industry, and the suburbs. When the electrical energy reaches the substation, it is stepped back again by a step-down transformer to a voltage close to the voltage it was generated (usually about 11 kV). This electricity can now be transferred to residential areas. This is known as secondary transmission.

Role of a Transformer

A transformer is a device used in the power transmission of electric energy. The transmission current is AC. It is commonly used to increase or decrease the supply voltage without a change in the frequency of AC between circuits. The transformer works on basic principles of electromagnetic induction and mutual induction transformer help to improve safety and efficiency of power system by rising and lowering the voltage of the current as per our needs. They have a wide application in residential and industrial, primary and perhaps the most important of all distribution and regulations of power across over large distance.

2. List the possible electrical Hazards inside a home?

Ans:

1. Poor wiring and defective wiring:
Poor wiring can increase the chance of fire, power surges, and arc faults with other dangerous consequences. Poor wiring can also increase the chance of an electrical accident. Hence it is necessary to do your wiring with good quality wire and from an electrical professional.

2. Outlets close to water:
Outlets in the bathroom, kitchen, and living room should be kept away from the water source as water is a good conductor of electricity. If kept near an outlet may lead to electric showers which can be harmful and may sometimes lead to death and also never use electrical appliances when near water.

3. Extension cord
Extension cord should be carefully placed where it reduces the chance of tripping. We should not use an extension cords as permanent for additional power sockets, and avoid using it for more appliances at once.

4. Pouring water on an electrical fire
The most common mistake people make is to put water on an electrical fire, avoid putting water on an electrical fire as it increases the fire's intensity. If you are afraid of an electrical fire, always keep a fire extinguisher on site. Never use water on an electrical fire.

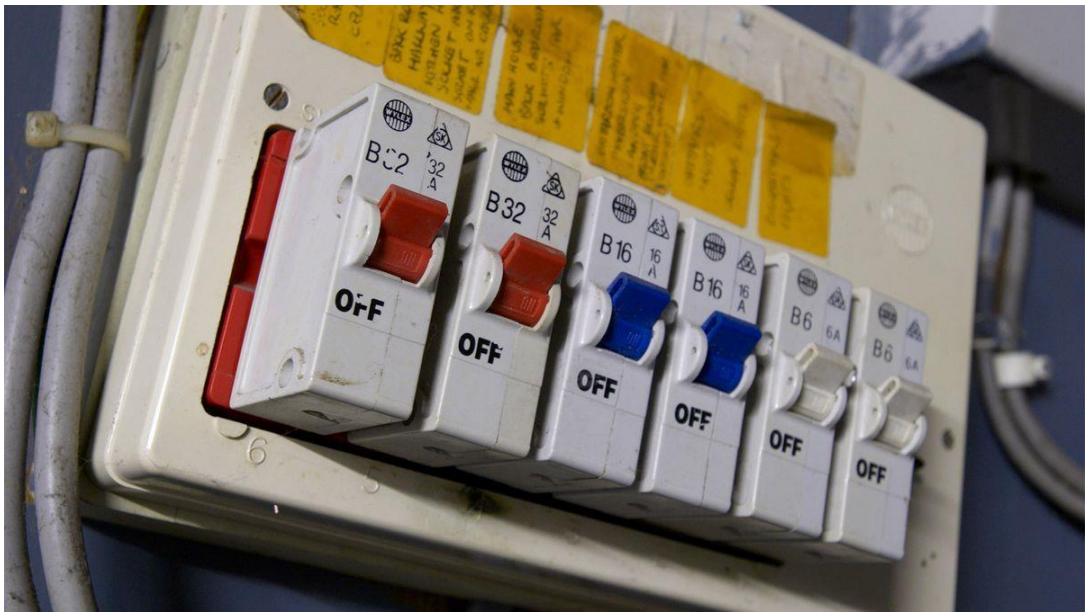
5. Light Bulbs
Light bulbs are often not considered an electrical hazard, but keeping them close to combustibles can lead to an electrical fire. This includes beds, curtains, plastic, or other items such as upholstery. Like all power supplies, lamps can cause electric shock. Therefore, be sure to turn off the light switch before replacing the bulb. Do not replace the bulb or touch the light switch with wet hands.

6. Improper grounding
7. Not proper ventilation for heavy current-carrying wires causing a heat up

3. **Electrical safety essentials: List and brief about Products for a safer home such as Circuit barkers, MCBs, Switch Fuse Unit (SFU, ELCB, MCCB.** **(Note: Students can add photographs of safety devices)**

Circuit breakers:

Circuit breakers are devices that protect circuits from overload current conditions. They do the same job as fuses, but they are not destroyed when activated as for fuse it is completely destroyed. They are more expensive to put in than fuses but since components rarely need to be replaced, circuit breakers function as an open switch that turns off all the current before excess electrical current starts a fire.



MCB(Minature circuit breaker):

An MCB is an automatically operated electrical switch. Miniature circuit breakers are intended to prevent damage to an electrical circuit as a result of excess current. They are designed to trip during an overload or short circuit to protect against electrical faults and equipment failure. MCBs are widely used as isolating components in domestic, commercial, and industrial settings. They form part of a broader family of more powerful circuit-breaking components.
MCB works on bipolar respective which provide protection against overload current and solenoid short circuit current. The other feature of MCB is rated current, not more than 125 amperes, its trip characteristic is normally not adjustable since it basically caters to low circuits.

SFU(Switch fuse unit):

SFU stands for switch fuse unit. SFU contains one switch unit and one fuse unit. The contact will get closed through the switch and then the supply will pass through the fuse unit in the output. Normally we use an HCR fuse in this kind of unit. We can select a suitable fuse rating based on the connected load. As technology developing SFU's are getting replaced with advanced MCCB's moulded Case Circuit Breaker)

ELCB(earthing leakage circuit breaker):

An ECLB is one kind of safety device used for installing an electrical device with high earth impedance to avoid shock. These devices identify small stray voltages of the electrical device on the metal enclosures and intrude the circuit if a dangerous voltage is identified. The main purpose of the Earth leakage circuit breaker (ECLB) is to stop damage to humans & animals due to electric shock. An ELCB is a specific type of latching relay that has a structure's incoming main power associated through its switching contacts so that the circuit breaker detaches the power in an unsafe condition. There are 2 types of ELCB voltage-operated and Current operator which is known as RCCB. Both ELCB have their unique property.

MCCB (Molded Case Circuit Breaker).

MCCB is used for motor feeders from 250 amps to 800 amps. This circuit breaker system protects the entire electrical system from overload and protects such conditions from short circuit problems. Simply put, these are electrical protection devices used primarily as MCCBs over a wide range of voltages and are well known for their adjustable trip settings and their ability to hold current values of up to 2500 amps.

4. What are the Types of Wires and Cables used for electricity distribution?

Ans- Today, with technological advances, almost everything is powered by electricity. we Require a smooth, uninterrupted power supply enabled by proper use of Wires and cables. The electrical sector uses cables and wires for power transmission and distribution to our house and industries some of them are:

1. **Direct Buried Cable (DBC)**
   A type of cable used for communication and power transmission. Direct buried cable (DBC) is a type of special telecommunications or transmission cable. Additional cover, coating, or Plumbing to protect it. It consists of a bundle of fibre optic cables with a thick metal core for rigidity. There are several protective layers like plastic insulation layer, waterproof layer There is also a shock-absorbing gel for protection From heat, humidity and other substrates caused. DBC is preferred in some regions. It is more resistant to the focus of Lightning discharges. Some power cables It was also buried directly. This type of wiring Follow strict government procedures regarding Installation and backfilling. This is usually used underground in areas where overhead cabling is impractical or dangerous.

2. **Armoured Cable**
   In electric power distribution, shielded cable usually means armoured steel wire cable (SWA) is the source of resistance cable designed for mains power electricity. It is one of many shielded power cables - included 11 kV cable and 33 kV cable - and is found in underground systems, the power network and cable tray. This metal-sheathed cable has a layer of protection twisted or braided metal layer usually made of steel over its conductor. Exterior plastic sheath. The metallic layer provides additional mechanical resistance against any type of failure and can also be used for ground connections. So they don't use in wet or humid places as well as underground. A protected layer can be a wire braid, a steel wire or steel tape. Steel Wire Armored Cable (SWA) is the most common type of sheathed cable used to transmit power.

3. **Overhead Power Line**
   Overhead power lines are conductors suspended from electrical towers or poles to transmit power over long distances. The conductors used are completely bare and made from aluminium. The electrical and mechanical properties of the conductor depend on its construction. Here are some of the cables used for power transmission:
   - **All Aluminum Conductor (AAC)**
     AAC transmission cable, also known as aluminium stranded conductor is made from multiple strands of hard drawn 1350 aluminium alloy which is 99 % pure with a little bit of silicon, iron etc. it has very high conductivity and resistive to corrosion but very poor strength to weight ratio. That is why it is preferred short distances in the stations, not for rural power transmission over long distances

- **All Aluminum Alloy Conductor (AAAC)**
  To increase the mechanical strength of the AAC cable, a special aluminium alloy is used made with magnesium and Silicium. It increases the strength to weight ratio while maintaining the corrosion resistivity. However, the conductivity falls a bit short due to resistance.
- **Aluminum Conductor Steel-Reinforced (ACSR) Cable**
  ACSR is also a stranded aluminum cable whose inner strands are made from galvanized steel surrounded by strands of pure aluminum conductors. The steel core increases the tensile strength of cable while the aluminum provides good conductivity and low weight. They are used in long distance transmission line because we can alter the strength of its steel core to meet the requirement.
- **Aluminum Conductor Aluminum-alloy Reinforced (ACAR)**
  It is made of pure aluminum conductors surrounding an aluminum core. The structure of ACAR resembles ACSR but instead of its core made from galvanized steel, it is made of aluminum alloy which increase the overall conductivity (ampacity) while maintaining the tensile strength of ACSR

5. **Importance of Earthing**.

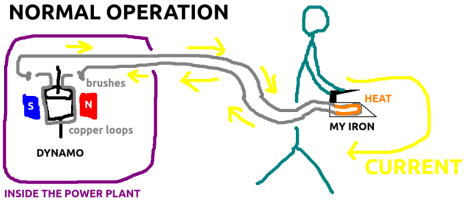
Ans-

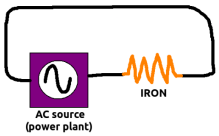
If there is a fault in your electrical installation, you may receive an electric shock if you touch it metal part under tension. This is because electricity can use your body as a conduit from the energized part to land. Grounding is used to protect you from electric shock. It does this by providing a path for a fault current to flow to the ground. This also causes the protective device to cut off the current. to the faulty circuit. For example, the refrigerator faults with the fault current flowing through the ground drivers. A protective device (fuse or circuit breaker) in the consumer box will trip the power supply for the kitchen. The refrigerator is now safe not to cause an electric shock to anyone who touches it.

Advantages of Earthing:

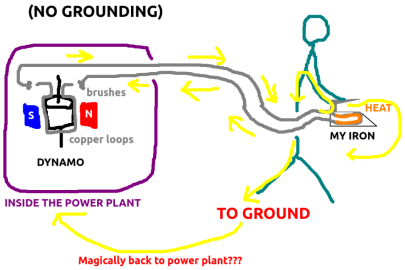
1. Earthing is safe and the best method of offering safety. We know that the earth's potential is zero and is treated as Neutral. Since low equipment is connected to earth using low resistance wire, balancing is achieved.
2. Proper earthing ensure the metal does not transfer current
3. A sudden surge in voltage or overload does not harm the device and person if proper earthing measures are done
4. It prevents the risk of fire hazards that could otherwise be caused by the current leakage

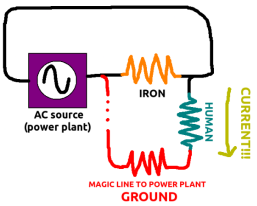
NORMAL OPERATION



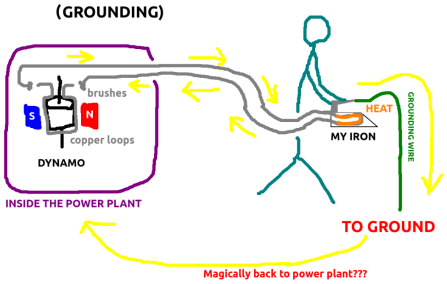


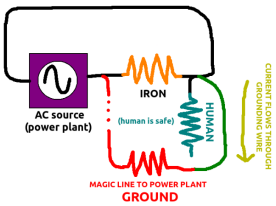
ELECTRIC WIRE TOUCHES IRON HANDLE (NO GROUNDING)





ELECTRIC WIRE TOUCHES IRON HANDLE (GROUNDING)





6. Explain in brief fluorescent, CFL, LED operations and typical power ratings. ?

Ans-

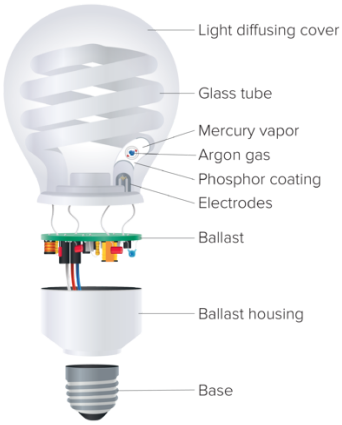
CFL

The term 'CFL' stands for Compact Fluorescent Lamp. It is also known as compact fluorescent light, energy-saving light, and compact fluorescent tube. This was designed to replace incandescent light in terms of efficiency and power consumption, CFL consists of a tube that is curved/spiralled to fit into the space of an incandescent bulb and a compact electronic ballast in the base of the lamp.

The compact arc tube of the lamp contains a high-pressure mixture of argon and mercury. Like a normal fluorescent tube, light is produced by passing an electric arc through a mixture of these gases. The ballast used ensures correct starting and operating voltage and regulates the flow of current in the lamp. The increased use of electronic ballast has eliminated the flicker and slow start associated with traditional fluorescent lamps. Compact fluorescent lamps generally emit a different light spectrum than incandescent lamps. But nowadays, with improved phosphorescence, lamps that emit a soft white light that resembles the colour of a standard incandescent lamp are also available. The

CFL also consists of a switching converter. It works very often and acts as a replacement for ballast (choke) and starter assemblies. The advantage of CFL is that it is more efficient than light bulbs and lasts longer (almost 10 to 15 times) compared to older light bulbs. It has a lower output than older bulbs (almost 80%). The typical power rating of a compact fluorescent light is only about 12-16 watts compared to a similar light bulb.

Fluorescent Bulb:



They operate at a very low gas pressure. Light is produced by them when an electric current passes between two electrodes called cathodes in a tube filled with low-pressure mercury vapour. It also contains inert gases such as argon and krypton. The electric current passes through the electrodes it excites the mercury vapour in the tube, generating radiant energy, primarily in the ultraviolet (UV) range. The tube consists of a phosphor coating on the inside. When the UV radiated by the mercury vapour falls on the phosphor coating, it is converted into visible light. Changing the composition of the phosphor powder inside fluorescent tubes changes the spectrum of light produced. Mercury is present in the lamp in both the phosphor powder and in the
vapour. Ballast is a device used in fluorescent lamps to provide and control the voltage in the lamp and stabilize the current in the circuit. Fluorescent lamps are more energy-efficient and have a longer lamp life than incandescent light bulbs of an equivalent brightness because more of the energy input is converted to usable light and less is converted to heat. The typical power rating is 12-16 watts.

LED-

LEDs create light by electroluminescence in a semiconductor material. Electroluminescence is the phenomenon of a material emitting light when an electric current or an electric field is passed through it - this happens when electrons are sent through the material and fill electron holes. An electron-hole exists where an atom lacks electrons (negatively charged) and therefore has a positive charge. Semiconductor materials like germanium or silicon can be "doped" to create and control the number of electron holes. Doping is the adding of other elements to the semiconductor material to change its properties. By doping a semiconductor you can make two separate types of semiconductors in the same crystal. The boundary between the two types is called a p-n junction. The junction only allows current to pass through it one way, this is why they are used as diodes. LEDs are made using p-n junctions. As electrons pass through one crystal to the other they fill electron holes. They emit photons (light). The typical power rating can a voltage of an LED is between 1.8 and 3.3 volts.

Light Output	LEDs	CFLs	Incandescents
Lumens	Watts	Watts	Watts
450	4-5	8-12	40
750-900	6-8	13-18	60
1100-1300	9-13	18-22	75-100
1600-1800	16-20	23-30	100
2600-2800	25-28	30-55	150