FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL ELECTRONICS ENGINEERING

ORIZU DAVID CHIBUEZE

UJ/20I9/EN/0072

ELECTRICAL ELECTRONICS ENGINEERING

EEE202 ASSIGNMENT 1

QUESTIONS

1. list four types of power generation and explain their operations briefly.

2. Describe how power is transmitted from the 320kv Thermal generating plant to the 11kv substation?

3. What is power factor correction? why is it important?

4. Draw a domestic earthing circuit for a house, list out the materials used, and explain their importance.

5. What is the synchronous generation and what is its importance?

6. Briefly explain A.C and D.C transmission and list out the advantages and disadvantages of each.

ANSWERS

1. list four types of power generation and explain their operations briefly

SOLUTION

I) Thermal power generation: This type of power generation involves the combustion of fossil fuels such as coal, oil, and natural gas to generate steam, which in turn drives a turbine to generate electricity.

2. Hydroelectric power generation: This involves converting the kinetic energy of flowing water into electrical energy, where water is channeled through a dam or a turbine to generate electricity.

3. Nuclear power generation: This involves the use of nuclear reactions to generate heat, which is then used to generate steam to drive a turbine that generates electricity.

4. Renewable power generation: This includes the use of renewable sources of energy such as solar, wind, and geothermal power. Solar power generation involves the use of photovoltaic cells to convert sunlight into electrical energy, wind power generation involves using the kinetic energy of wind to drive turbines to generate electricity while geothermal

power generation involves using the heat generated by the earth to produce steam, which in turn drives a turbine to generate electricity.

2. Describe how power is transmitted from the 320kv Thermal generating plant to the 11kv substation?

SOLUTION

Power is transmitted from the 320kv thermal generating plant to the 11kv substation through a series of steps which are as follows:

1. Step-up transformer: The power generated at the thermal plant is initially transmitted at a voltage of 320kv. This high voltage power is then passed through a step-up transformer which increases the voltage to a very high level, typically in the range of 400kv to 800kv.

2. Transmission lines: The high voltage power produced by the step-up transformer is then transmitted through long distance transmission lines which are typically made of aluminum or copper and are suspended on high towers. The transmission lines are designed to minimize losses and maintain the quality of power during transmission.

3. Step-down transformers: At various intermediate points along the transmission line, the high voltage power is passed through step-down transformers which reduce the voltage to a

suitable level for distribution. The voltage is typically reduced to 33kv or 11kv.

4. Distribution substation: The power is finally transmitted to the 11kv substation where it is stepped down further to 11kv, which is the voltage level used for distribution. The substation is equipped with circuit breakers, transformers, and other equipment to handle the power coming in and out.

5. Distribution network: From the 11kv substation, the power is distributed through a network of power lines, transformers, and other equipment to end-users such as homes, businesses, and industries.

In summary, power is transmitted from the 320kv thermal generating plant to the 11kv substation through high voltage transmission lines and multiple step-up and step-down transformers to ensure efficient and reliable distribution of power.

3. What is power factor correction? why is it important?

SOLUTION

Power factor correction is the process of improving the power factor of an electrical system by reducing the lagging power factor caused by inductive loads. The power factor is the ratio of real power to apparent power in an AC circuit and is expressed as a value between 0 and 1. A low power factor

means that a greater amount of power is required to perform the same amount of work, resulting in inefficiency and higher energy costs.

Improving power factor through power factor correction measures, such as adding capacitors to the circuit, can help to reduce energy usage and improve system efficiency. This is important not only from an economic standpoint but also from an environmental perspective as it reduces greenhouse gas emissions and helps to conserve natural resources.

In addition, power factor correction can also improve the reliability of electrical equipment and reduce the risk of equipment failure due to overstress or overheating caused by an underperforming system. Therefore, power factor correction is an important aspect of efficient electrical systems and the use of sustainable energy resources.

4. Draw a domestic earthing circuit for a house, list out the materials used, and explain their importance.

SOLUTION

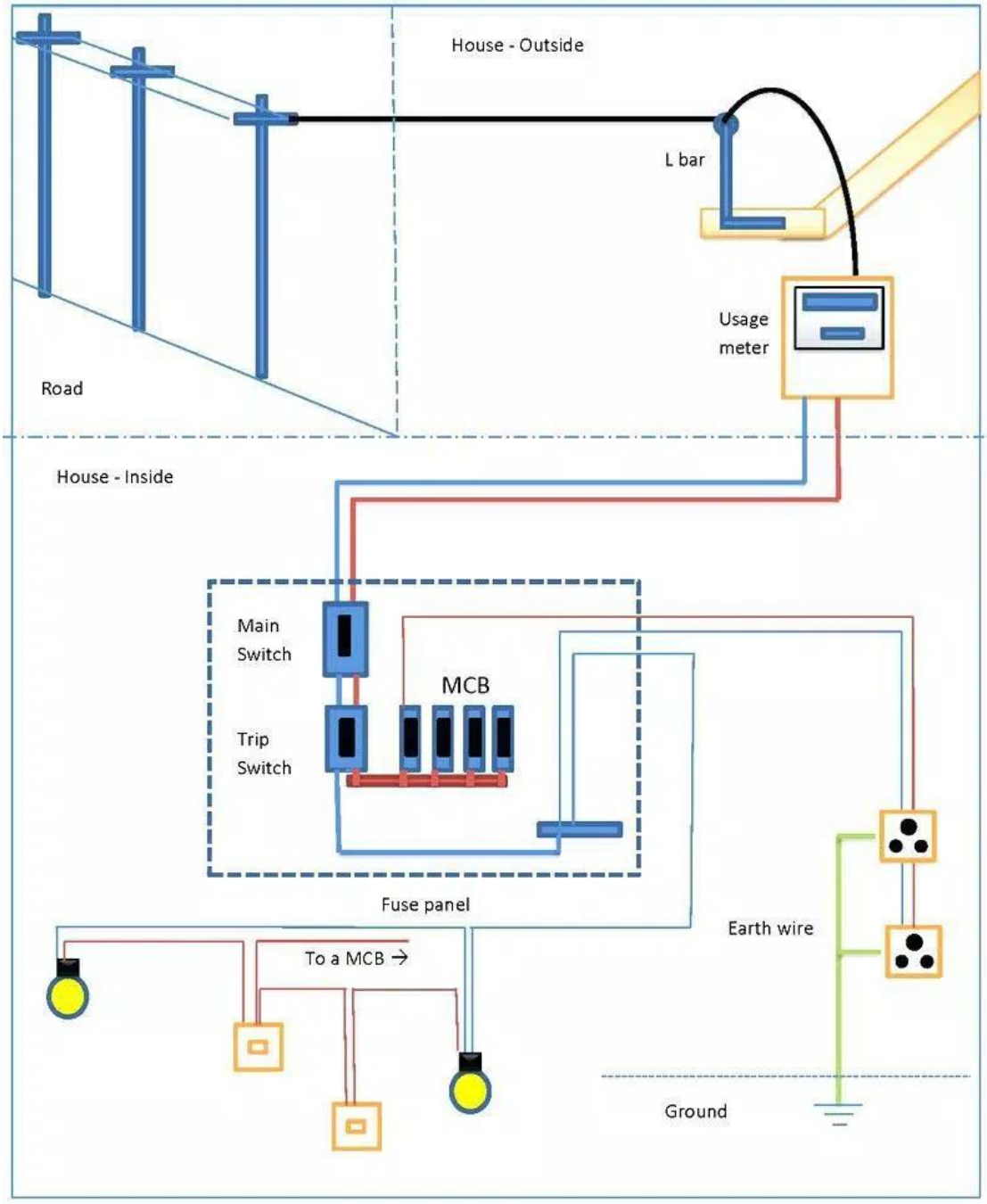

DIAGRAM OF DOMESTIC EARTHING CIRCUIT FOR HOUSE

Materials used in a domestic earthing circuit:

1. Copper rod: The copper rod is used as a grounding electrode to connect the electrical system to the earth. It serves as a path

for current to flow into the earth and reduces the risk of electrical shock and damage to electronic devices due to lightning strikes or power surges.

2. Copper wire: Copper wires are used to connect the electrical system and the grounding electrode. Copper wire offers excellent conductivity and corrosion resistance, which makes it ideal for use in the earthing circuit.

3. Clamp: A clamp is used to connect the copper wire to the grounding electrode. The clamp ensures a secure and solid connection between the grounding electrode and the copper wire.

4. Earth pit: An earth pit is a hole in the ground where the grounding electrode is placed. The earth pit provides a moist environment that helps to maintain a constant low resistance between the grounding electrode and the earth.

5. Earth tester: An earth tester is a device used to measure the resistance of the grounding circuit. It helps to determine if the earthing circuit is functioning correctly and provides an indication if any corrective action is required.

Importance of materials used in a domestic earthing circuit:

The above materials are essential components of a domestic earthing circuit as they help to protect the electrical system and the occupants of the house from electrical shocks and damage

due to lightning strikes or power surges. The grounding electrode and copper wire provide a low resistance path for current to flow into the earth, reducing the risk of voltage buildup and potential electrical hazards. The clamp ensures a secure and solid connection between the grounding electrode and copper wire, minimizing the risk of disconnection or deterioration. The earth pit provides a moist environment that helps to maintain a constant low resistance between the grounding electrode and the earth, improving the effectiveness of the earthing circuit. The earth tester helps to ensure that the earthing circuit is functioning correctly, providing an indication if any corrective action is required to maintain a safe and reliable grounding system.

5. What is the synchronous generation and what is its importance?

SOLUTION

Synchronous generation refers to the production of electricity in which the rotational speed of the generator is synchronized with the frequency of the electrical grid it is connected to. This allows for the efficient and reliable production of electricity, as the generator is able to match the frequency and voltage of the grid, ensuring a constant and steady supply of power.

The importance of synchronous generation lies in its ability to stabilize the electrical grid, providing a consistent supply of energy to homes, businesses, and industries. It also allows for the integration of renewable energy sources, such as wind and

solar power, into the grid, as the synchronized generator can compensate for their intermittent output and ensure a stable electrical supply. Overall, synchronous generation is a critical component of modern electricity systems, providing reliable and consistent energy to power a wide range of activities and industries.

6. Briefly explain A.C and D.C transmission and list out the advantages and disadvantages of each.

SOLUTION

A.C Transmission:
A.C (Alternating Current) transmission is the transmission of electrical power through power lines using alternating current. The voltage of A.C transmission can be increased or decreased using transformers which is one of the main advantages of A.C transmission. A.C transmission is used for long distance transmission of power because it has low losses. It is also more efficient than D.C transmission.

Advantages of A.C Transmission:
1. A.C transmission is more efficient than D.C transmission.
2. A.C transmission can be transmitted over long distances with minimal losses.
3. A.C transmission can be transformed easily into different voltage levels.

Disadvantages of A.C Transmission:

1. A.C transmission is not suitable for underwater and underground power transmission.
2. A.C transmission requires more expensive transformers to transmit power over long distances.
3. A.C transmission is more susceptible to electromagnetic interference.

D.C Transmission:
D.C (Direct Current) transmission is the transmission of electrical power through power lines using direct current. D.C transmission was used in the past because it was easier to generate and transmit. D.C transmission is used for high voltage, low current transmission.

Advantages of D.C Transmission:
1. D.C transmission is less susceptible to electromagnetic interference.
2. D.C transmission is suitable for underwater and underground power transmission.
3. D.C transmission is less expensive to transmit power over long distances.

Disadvantages of D.C Transmission:
1. D.C transmission is less efficient than A.C transmission due to high losses.
2. D.C transmission cannot be easily transformed into different voltage levels.
3. D.C transmission requires expensive rectifiers to convert the A.C power into D.C power.