Session 4

Class 1 on Grounding systemGrounding system

A lab session on grounding systems aims to provide practical experience and understanding of the importance, design, and testing of grounding systems in electrical installations. Here's a step-by-step guide for conducting a lab session on grounding systems:

Introduction: Begin the lab session with an overview of grounding systems. Explain the purpose of grounding, which includes ensuring electrical safety, protecting equipment, and minimizing the risk of electrical faults. Discuss the various types of grounding systems, such as single-point grounding, multiple-point grounding, and isolated grounding.

Grounding System Design:

a. Grounding Electrodes: Demonstrate the installation and connection of grounding electrodes, such as ground rods or plates, to the electrical system. Discuss the materials used for grounding electrodes and their specifications.

b. Grounding Conductors: Show participants how to select and install grounding conductors, such as copper or aluminum cables, to connect the grounding electrodes with the main grounding bus or grounding electrode system.

c. Grounding Bus/System: Explain the purpose and construction of grounding busbars or grounding electrode systems. Show participants how to properly connect and install the grounding conductors to the grounding bus or electrode system.

Grounding System Testing:

a. Earth Resistance Measurement: Demonstrate the measurement of earth resistance using a ground resistance tester or a digital multimeter. Show participants how to perform earth resistance tests at different locations within the grounding system and interpret the test results.

b. Ground Fault Testing: Simulate ground faults within the electrical system and demonstrate the detection and response of the grounding system. Use appropriate test equipment to measure fault currents and discuss the importance of effective grounding in fault mitigation.

Lightning Protection:

a. Lightning Rod Installation: Show participants how to install lightning rods or air terminals as part of the grounding system. Discuss the proper placement and configuration of lightning rods to ensure effective lightning protection.

b. Surge Protection Devices: Explain the use of surge protection devices (SPDs) in grounding systems to protect against transient voltage surges. Demonstrate the installation of SPDs and discuss their role in diverting surge currents away from sensitive equipment.

Grounding System Maintenance:

a. Visual Inspection: Demonstrate the visual inspection process for grounding systems, including checking for loose connections, corrosion, and physical damage. Emphasize the importance of regular inspections to ensure the integrity of the grounding system.

b. Grounding System Resistance Testing: Show participants how to perform periodic resistance tests on the grounding system to ensure its continued effectiveness. Discuss the significance of maintaining low resistance values for proper grounding.

c. Maintenance and Repair: Discuss common maintenance tasks, such as cleaning connections, re-tightening terminals, and repairing damaged grounding conductors. Provide guidance on troubleshooting common grounding system issues, such as high resistance or improper connections.

Documentation and Analysis: Document the observed results, measurements from testing, and any maintenance recommendations related to the grounding system. Encourage participants to analyze the data and discuss the importance of regular maintenance and testing for the reliability and safety of grounding systems.

Q&A and Discussion: Conclude the lab session with a question-and-answer session and open discussion. Address any queries or concerns raised by the participants and encourage them to share their experiences and insights related to grounding systems.

Throughout the lab session, prioritize safety by following appropriate protocols and guidelines for working with electrical systems and equipment. Emphasize the importance of understanding the role and proper maintenance of grounding systems in electrical installations to ensure electrical safety and equipment protection.

Class 2 on Auxiliary System in Switchyard/Substation

A lab session on auxiliary systems in switchyards/substations focuses on providing practical experience and understanding of the various auxiliary systems used to support the operation and control of electrical switchyards or substations. Here's a step-by-step guide for conducting a lab session on auxiliary systems:

Introduction: Begin the lab session by providing an overview of switchyards/substations and the importance of auxiliary systems. Explain that auxiliary systems are essential for supporting the main electrical equipment, ensuring their proper functioning, and facilitating control and monitoring.

Auxiliary System Components:

a. Battery and Battery Charger: Demonstrate the installation and connection of batteries and battery chargers used to provide backup power for critical systems during power outages. Explain the different types of batteries used, such as lead-acid or nickel-cadmium, and the importance of regular battery maintenance.

b. DC Distribution System: Show participants the DC distribution system used to supply DC power to various equipment and control circuits. Demonstrate the installation of DC panels, circuit breakers, and the proper routing of DC cables.

c. AC Distribution System: Discuss the AC distribution system used to supply power to auxiliary equipment and non-critical loads. Demonstrate the installation of AC panels, circuit breakers, transformers, and the proper routing of AC cables.

d. Control and Protection Systems: Introduce control and protection systems, including supervisory control and data acquisition (SCADA) systems, remote terminal units (RTUs), and protection relays. Explain their role in monitoring and controlling the switchyard/substation equipment and providing system protection.

Hands-on Exercises:

a. Battery Maintenance: Demonstrate the battery maintenance procedures, such as visual inspection, checking electrolyte levels, measuring specific gravity, and performing battery capacity tests. Show participants how to interpret the results and identify potential battery issues.

b. DC Distribution Testing: Show participants how to test the DC distribution system for proper voltage levels, continuity, and insulation resistance using appropriate test equipment. Discuss the significance of these tests in ensuring the integrity of the DC distribution system.

c. AC Distribution Testing: Demonstrate the testing procedures for the AC distribution system, including voltage measurements, load testing, and checking for proper grounding. Explain the importance of maintaining balanced loads and verifying proper grounding.

d. Control and Protection System Demonstration: Provide participants with a demonstration of the control and protection systems in action. Show how these systems monitor and control equipment, detect faults, and initiate appropriate actions for system protection.

Documentation and Analysis: Document the observed results, measurements from testing, and any maintenance recommendations related to the auxiliary systems. Encourage participants to analyze the data and discuss the importance of regular maintenance and testing for the reliable operation of auxiliary systems.

Q&A and Discussion: Conclude the lab session with a question-and-answer session and open discussion. Address any queries or concerns raised by the participants and encourage them to share their experiences and insights related to auxiliary systems in switchyards/substations.

Throughout the lab session, prioritize safety by following appropriate protocols and guidelines for working with electrical systems and equipment. Emphasize the importance of understanding the role and proper maintenance of auxiliary systems in switchyards/substations to ensure the reliability and functionality of the overall electrical system.