Session 5

Class 1 on Design Over current

Designing an experiment on overcurrent protection involves simulating overcurrent conditions and testing the effectiveness of protective devices in interrupting the fault current. Here's an outline for conducting an experiment on the design of overcurrent protection:

Objective: Define the objective of the experiment, which could be to determine the performance of overcurrent protective devices in interrupting fault currents and evaluating the coordination between different protective devices.

Experimental Setup:

a. Power Supply: Set up a power supply system that can provide a controlled current source for the experiment. This can be achieved using a current-limited power supply or a variable power supply with a current-limiting feature.

b. Circuit Configuration: Construct a circuit configuration that includes a power source, protective devices (circuit breakers, fuses, or relays), load, and fault simulation devices. Ensure the circuit configuration represents a typical electrical system.

c. Fault Simulation: Introduce fault simulation devices, such as fault resistors or fault boxes, to create controlled fault currents in the circuit. These devices should be capable of producing different levels of fault currents for testing purposes.

d. Protective Devices: Install the overcurrent protective devices in the circuit, such as circuit breakers or fuses. Ensure they are appropriately rated for the expected fault currents and connected according to standard installation guidelines.

Experimental Procedure:

a. Fault Current Testing: Gradually increase the fault current level using the fault simulation devices while monitoring the behavior of the protective devices. Start with a low fault current and progressively increase it to higher levels to simulate different fault scenarios.

b. Time-Current Characteristics: Record the time-current characteristics of the protective devices during the fault current testing. Measure and document the time it takes for the protective devices to trip or interrupt the fault current at different current levels.

c. Coordination Analysis: Analyze the coordination between protective devices by comparing the time-current characteristics of each device. Determine if the protective devices operate in a coordinated manner, with upstream devices tripping before downstream devices.

d. Protective Device Response: Observe and document the response of the protective devices during fault conditions. Note any abnormal behavior or malfunctions that may occur during the experiment.

Data Collection and Analysis:

a. Data Recording: Record the measured fault currents, tripping times, and any observations made during the experiment. Ensure accurate and detailed documentation of the experimental data.

b. Data Analysis: Analyze the collected data to evaluate the performance of the protective devices. Calculate the time-current grading and evaluate the coordination between the protective devices. Identify any discrepancies or issues that may arise during the testing.

Discussion and Conclusion:

a. Interpretation: Interpret the experimental results and discuss the performance of the protective devices under overcurrent conditions. Analyze any observed deviations from expected behavior and discuss possible causes.

b. Conclusion: Summarize the findings of the experiment and draw conclusions regarding the effectiveness of the overcurrent protection design. Discuss the importance of properly coordinating protective devices and selecting appropriate protective devices for specific applications.

Safety Measures: Emphasize the importance of following safety protocols during the experiment, such as using appropriate personal protective equipment, working with low voltage, and ensuring proper grounding.

Q&A and Discussion: Conclude the experiment 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 overcurrent protection design.

Note: It is crucial to consult safety guidelines, regulations, and local standards while designing and conducting electrical experiments. Ensure the experiment is performed under the supervision of qualified personnel and adhere to safety precautions to prevent any potential hazards.

Class 2 on Protection for sub-station Feeder

Designing an experiment on protection for a substation feeder involves simulating fault conditions and testing the performance of protective devices in detecting and isolating faults. Here's an outline for conducting an experiment on protection for a substation feeder:

Objective: Define the objective of the experiment, which could be to evaluate the effectiveness of protective devices in detecting and isolating faults in a substation feeder and analyzing the coordination between different protection elements.

Experimental Setup:

a. Feeder Configuration: Set up a representative substation feeder configuration that includes a power source, protective devices (circuit breakers, relays), load, and fault simulation devices. Ensure the feeder configuration reflects the typical characteristics of a substation feeder.

b. Protection System: Install protective devices, such as overcurrent relays, differential relays, distance relays, and communication devices, in the feeder circuit. Ensure the protective devices are appropriately rated and connected according to standard installation guidelines.

c. Fault Simulation: Introduce fault simulation devices, such as fault resistors or fault boxes, to create controlled faults in the substation feeder. These devices should be capable of producing different types of faults, including short circuits, ground faults, and phase-to-phase faults.

Experimental Procedure:

a. Fault Testing: Introduce controlled faults at different locations and types along the substation feeder. Start with simple faults, such as phase-to-phase or phase-to-ground faults, and gradually progress to more complex faults to simulate realistic scenarios.

b. Protective Device Response: Monitor and record the response of the protective devices during fault conditions. Note the time it takes for each protective device to detect the fault, trip the associated circuit breaker, and isolate the faulted section of the substation feeder.

c. Coordination Analysis: Analyze the coordination between the protective devices by comparing their response times and characteristics. Evaluate if the protective devices operate in a coordinated manner, with upstream devices tripping before downstream devices.

d. Communication System Testing: If applicable, test the performance of the communication devices used for remote monitoring and control of the substation feeder. Verify if fault signals are properly transmitted and received by the control center or remote monitoring system.

Data Collection and Analysis:

a. Data Recording: Record the fault types, fault locations, protective device response times, and any observations made during the experiment. Ensure accurate and detailed documentation of the experimental data.

b. Data Analysis: Analyze the collected data to evaluate the performance of the protective devices in detecting and isolating faults. Assess the coordination between the protective devices and identify any discrepancies or issues that may arise during the testing.

Discussion and Conclusion:

a. Interpretation: Interpret the experimental results and discuss the performance of the protective devices in detecting and isolating faults in the substation feeder. Analyze any observed deviations from expected behavior and discuss possible causes.

b. Conclusion: Summarize the findings of the experiment and draw conclusions regarding the effectiveness of the protection system for the substation feeder. Discuss the importance of properly coordinated protective devices and reliable communication systems for fault detection and isolation.

Safety Measures: Emphasize the importance of following safety protocols during the experiment, such as using appropriate personal protective equipment, working with low voltage, and ensuring proper grounding.

Q&A and Discussion: Conclude the experiment 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 protection for substation feeders.

Note: Ensure the experiment is performed under the supervision of qualified personnel and adheres to safety precautions and regulations. Consult safety guidelines and local standards specific to electrical testing and protection systems.