Introduction:

This course offers an in-depth exploration of the essential principles and advanced techniques in electrical power protection. It covers a range of protection devices such as relays, which are crucial for safeguarding various components of the electrical power distribution network.

A relay acts as a protection device in the system, isolating defective components when necessary. Understanding how these protection mechanisms work is fundamental for professionals in the electrical power system protection field. This comprehensive course equips participants with knowledge on the role of electrical protection systems in maintaining the integrity of power distribution networks.

The course is designed to prepare professionals for a **Power Systems Certificate** and provides valuable insights into the technologies and strategies for protecting electrical infrastructure, from protective relay training to understanding the full scope of electrical power system protection.

Targeted Groups

This course is suitable for the following groups:

- **Engineers and Technicians** in the Electricity Supply Industry.
- **Technical Management Professionals** and Department Leaders.
- **Engineering Professionals** involved in the manufacturing and operation of power and distribution transformers.
- **Engineers and Technical Personnel** working in power utilities, petrochemical plants, and large infrastructure projects.
- **Maintenance and Operations Technicians** seeking expertise in electrical protection training and power system protection.

Course Objectives

Upon completion of this course, participants will be able to:

- Comprehend various **types of electrical faults** and their causes.
- Understand the practical aspects of specifying the appropriate **electrical protection systems**.
- Gain expertise in **protective relay training** and the selection of relays for different applications.
- Design and develop effective **protection schemes** for electrical systems.
- Master the construction and functionalities of **instrument transformers**.
- Learn various **grounding systems** and **earth fault protection techniques**.

Targeted Competencies

By the end of the course, participants will demonstrate:

- Proficiency in the **operational principles** and **types of electrical power system protection**.
- The ability to design and implement different types of **relays** for protection.
- Knowledge of **protection coordination** and system architecture.
- Skills in **protection mechanisms** for feeders, motors, and transformers.
- The ability to perform **short circuit current calculations**.
- The foundational knowledge required to earn a **Power Systems Certificate**.

Course Content

Unit 1: Types of Electrical Protection Devices and Faults

- The importance of **electrical power protection** and control devices.
- Identifying **types of electrical faults** in power systems.
- Characteristics of **high voltage fuses** and **circuit breakers** for protection.
- Overview of **microprocessor overcurrent relays** and their working principles.
- Understanding **time-current curves**, **logic discrimination**, and the difference between **hot and cold tripping curves**.
- Protection for **low voltage switchboards** against **short circuits**.

Unit 2: Protection Functions and Instrument Transformers

- Understanding the overall **power system architecture**.
- Introduction to **protection functions** and the concept of **selective coordination**.
- Features of **lockout** and **anti-pumping relays**.
- Role of **sensors** in electrical systems.
- Overview of **current** and **voltage instrument transformers**.
- Explanation of **numerical relays** and their functions.

Unit 3: Busbar, Transformer, and Motor Protection Systems

- Protection techniques for **busbars**.
- Transformer **protection techniques** and their applications.
- Protection systems for **motors** and **capacitors**.
- **Overhead line protection** and **fault types**.
- Key **protection functions** and device coordination.
- Setting **circuit breaker relay settings** and **current transformer sizing**.
- **Short-circuit current calculation methods** and busbar **rating selections**.
- Designing an **11kV air-insulated switchgear substation**.

Unit 4: Grounding Systems and Earth Fault Protection

- Mechanisms for **overcurrent protection** in **phase** and **earth faults**.

- Overview of **unit protection schemes**.
- Understanding **distance protection** for feeders and systems.
- Protection strategies for **overload** and **short circuit**.
- Analysis of **grounding systems** used in electrical power systems.
- Implementation of **restricted earth fault protection** and **sensitive earth fault protection**.
- **Protection against over-voltages**.

Unit 5: Methods of Commissioning Relays, Short Circuit Current Calculation, and Harmonics

- The process of **commissioning protective relays**.
- **Short circuit current calculations** and fault topologies.
- Understanding **positive**, **negative**, and **zero sequence systems** in power systems.
- Impact of **triple harmonics** and techniques for **mitigating** harmonic effects.

Conclusion: By the end of this course, participants will possess a comprehensive understanding of electrical protection devices and systems. This knowledge equips them to design, implement, and maintain robust protection mechanisms in electrical power systems. Whether you are looking to advance your career in power systems or obtain a specialized certification, this course provides the necessary skills and expertise for success in the field of electrical protection.