



Content  
Community  
Connection

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Contact us Today for a FREE quotation to deliver this course at your company's location.

<https://www.electricityforum.com/onsite-training-rfq>

Refresh your knowledge of the industrial and utility system protection techniques including fault analysis and overvoltage assessment. Develop your own relay settings and thoroughly understand the philosophy of protective systems. Study actual cases illustrating various techniques in present use and highlighting particular approaches used by experienced system designers. Enhance your experience with power system protection problems generally faced, and solutions successfully adopted, by industry. Understand how to apply microprocessor-based multifunction relays for the protection of various power system equipment and apparatus.

Power System Protection Training teaches students how to make sure that downstream devices (breakers/fuses) should activate before upstream devices and therefore protect their electrical systems. By doing this, it minimizes the portion of the system affected by a fault or other disturbance. At the substation level, feeder breakers should trip before the main. Likewise, downstream panel breakers should trip before the substation feeder supplying the panel.

DER Integrated Power System Protection and Coordination of various electrical equipment and apparatus requires a good understanding of phase and ground short circuit currents, detection, and safe clearing of the faulted equipment. This DER integrated Power System Protection and Coordination Training Course provides a practical and comprehensive description of the principles and concepts of analysis, application and operation of protection schemes for various power system elements such as feeders, transformers, motors, buses, generators, etc. The Power System Protection And Coordination Training course starts with

an overview of power system fundamentals, design and short circuit calculations which lead to the understanding of protection scheme requirements and their applications. Protection requirements for industrial plants, cogeneration, and interconnection with the utility power system are explained in detail. This course covers the subject of power system protection from a practical perspective, and includes important functional aspects such as testing and coordination of protection systems. This course is designed for individuals who are involved with industries and utilities which depend on proper system protection for operational efficiency and minimizing damage to equipment.

### **WHO SHOULD ATTEND**

- Electrical Power Distribution Engineers;
- Electrical Power System Planners;
- Electrical Power System Engineers;
- Plant Managers;
- Consulting Engineers;
- Electrical Engineers and Technical Staff entering the protection field,
- Engineers and technicians involved with design, operation, maintenance, testing, and troubleshooting of high and medium voltage electrical systems and equipment.
- Technicians and technologists in the industrial, consulting, and utility fields involved in design, operation and maintenance who require knowledge of electrical system protection techniques.

### **STUDENTS RECEIVE**

#### **The Power System Protection And Coordination Engineering Training Course:**

- Will Reduce Unnecessary Downtime!
- Provide Recommended Settings For Adjustable Trip Circuit Breakers And Relays.
- Will Increase Coordination (Selectivity) Between Devices.
- Identify Deficiencies In System Protection.

- Will Provide Recommended Solutions To Help Correct Your Problem Areas.
- Reviews And Discussion On The Use Of System Devices With Respect To Electrical Code Requirements, And Appropriate ANSI/IEEE Standards

## **COURSE OUTLINE**

### **DAY ONE**

#### **SESSION 1: POWER SYSTEM FAULTS**

- Different Types Of Faults
- Incidence Of Faults On Power System Equipment
- Effects Of Power System Faults
- Magnitude Of Fault Current, Short Circuit Calculations
- Detection Of Faults
- Clearance Of Faults
- Requirements Of Protective Relaying Systems

#### **SESSION 2: POWER SYSTEM CONFIGURATIONS**

- Typical System Configurations
- Design Considerations
- Radial Systems, Loop Systems, Selective Systems
- DER and integrated bulk power configuratio

#### **SESSION 3: DER, RENEWABLES AND BULK POWER INTEGRATION**

- Technology Issues in the modern "Distributed Energy Resources" ("DER")
- From Smart Grid to Smart Energy Use
- The Smart Grid Vision and Roadmap for Florida, Texas and California
- Realizing the Potential of Renewable and "Distributed Energy Resources" ("DER")
- Renewables Integration Through Direct Load Control and Demand Response

- The Florida/California experience with DER and outcome
- Energy Storage
- DER in Transmission and Distribution
- Case Study: Integrating 33% Renewables & DER into the Power Grid

#### **SESSION 4: FAULT STUDIES AND DER**

- Equipment Ratings
- Asymmetric Factors
- Purposes Of Fault Calculations
- Types Of Faults
- Modeling Methods
- Fault Calculations
- Faults where DER is fully integrated

#### **SESSION 5: COMPONENTS OF POWER SYSTEM PROTECTION SCHEMES**

- Fault Detecting Relays
- Tripping Relays And Other Auxiliary Relays
- Circuit Breakers - Bulk Oil, Air-Blast, Vacuum, SF6
- Current Transformers
- Voltage Transformers
- Ground Transformers
- Transition From Electro-Mechanical To Electronic And Microprocessor-Based Relays
- The Application Of Programmable Logic Controllers
- Modern Microprocessor-Based Relays: Review Of Types Available

#### **SESSION 6: CURRENT (CTS) & VOLTAGE TRANSFORMERS (VTS)**

- Various Types Of CTs, VTs & CVTs
- Theory And Characteristics Of CTs

- Application Requirements Of CTs For Protective Relaying
- Accuracy Classifications
- Future Trends In CT Design
- Testing Of CTs And VTs

## **DAY TWO**

### **SESSION 7: COORDINATION OF ELECTRICAL PROTECTION SCHEMES**

- Fuse To Fuse
- Circuit Breaker To Fuse
- Fuse To Circuit Breaker
- Back Up Protection
- Limitation Of Fault Current
- Selective Zones Of Protection
- Types Of Bus Protection Schemes
- Basic Concept Of Differential Protection
- Application To Various Bus Configurations
- Applications To Switchboards
- Testing Of Bus Protection Schemes

### **SESSION 8: UTILITY AND DISTRIBUTION FEEDER PROTECTION**

- Protective Relaying Requirements For Loop And Radial Systems
- Elements Of Feeder Protection Schemes
- High Set, Low Set, And Inverse -Timed Elements
- Coordination With Other Devices And Fuses
- Auto-Reclosing Of Feeder Circuit Breakers
- Various Types Of Overcurrent Relays
- Electromechanical, Electronic & Digital Relays
- Relay Setting Criteria

- Testing Of Overcurrent Protection Schemes

## **SESSION 9: TRANSFORMER PROTECTION**

- Protection Characteristics
- Data Requirements
- Basic Protection Systems
- Factors Affecting Protection
- Overload Protection
- Phase And Ground Fault Protection
- Primary Fuse Protection
- Primary Breaker Protection
- Substation Design issues and DER

## **SESSION 10: TRANSMISSION LINES PROTECTION**

This part of the course will examine the protection required for main feeders coming from the distribution substation and the branches that feed local area distribution. There will be a review of protection requirements for lines outside the substation and then deal with upstream protection requirements for relays that protect the main feeders at the substation.

- Differential, Distance and Traveling-Waves Protection

## **SESSION 11: SUBSTATION TRANSFORMER PROTECTION**

A review of substation transformers and required protection settings, including how to deal with transformer inrush and pickup current. How to protect a substation transformer and how to coordinate protection with upstream and downstream equipment.

## **SESSION 12: DISTRIBUTION TRANSFORMER PROTECTION**

This part of the course will deal with transformer loading capabilities, withstand curves, fusing ratio and the need to limit fault energy.

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