THE ELECTRICITY FORUM
Content Community Connection

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Advanced Protective Relay Training

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

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

A properly designed protection system has downstream devices (breakers/fuses/relays) should activating before upstream devices. This 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.

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.

Our Advanced Protective Relay 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 Advanced Protective Relay 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.

COURSE OBJECTIVES

To provide a practical understanding of protective device applications and protective relay schemes for electrical power systems and equipment. Refresh your knowledge of the basic industrial 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.

COURSE BENEFITS

The Advanced Protective Relay 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 discussions on the use of protective devices with respect to Electrical Code requirements, and appropriate ANSI/IEEE standards

WHO SHOULD ATTEND

Electrical Engineers, technicians and technologists in the industrial,commercial, and institutions, consulting electrical engineers, and electric utilities who involved in power system protection. This course is also appropriate for power system operation and maintenance personnel who require knowledge of electrical system protection techniques.

STUDENTS RECEIVE

- This Course Includes Our Latest Digital Electrical Protection Handbook!! (Value $20)
- **$100 Coupon** Toward any Future Electricity Forum Event (Restrictions Apply)
- 1.4 Continuing Education Unit (CEU) Credits for each day of Training
- **FREE** Magazine Subscription (Value $25.00)
- Course Materials in Paper Format

COURSE OUTLINE

DAY ONE

Session 1: Introduction to power system protection and coordination

- Types of electrical protection for power systems
- Fuses for high voltage and medium voltage systems
- Time current characteristics of the power fuses
- Fixed and variable tripping of a power fuse
- Expulsion type fuse, advantage and limitations
- Cable protection in line fuses
- Reducing the arc flash in case an event happen

Session 2: Engineering tools for power system analysis

- Phasors, polarity and symmetrical components
- Polarity in relay circuits
- Fault types and causes, fault characteristics
- Fault evaluation methods
- Example of a calculation for power system faults

Session 3: Understanding the power system protection relays

- Classification of protection relays
- Voltage and current instrument transformers
- Zero sequence network
- Electromechanical units: magnetic units; induction units; thermal units; d'arsonval units
- Solid state units,: semiconductor components; solid state logic units; fault sensing and amplification units
- Basic logic circuits and operation
- Microprocessor controlled relays

Session 4: Integrated power system protection devices

- Bessel integrated protection units
- GE integrated relay systems-multiline G60; G30 and other GE protection integrated relay
- Switzer laboratory integrated solutions - SEL protection family
- ABB integrated relays dpu/tpu relay family
- Cooper protection relays
- Vamp protection integrated relays
- Siprotec Siemens relays

- Micom schneider protection relay family
- Comparing the main manufacturer protection relay performance

Session 5: System protection philosophy, location of the power system protection relay

- Defining the relay protection zone and functions
- Standards and code requirements for electrical system protection
- Integrating the protection relay to the power distribution system
- Selection of the best strategy of protecting the power system
- Correlation between the power system protection and the grounding configuration, solid grounding; resistive grounding and impedance grounding
- Strategy of replacing obsolete protection relay systems

Session 6: Balanced and unbalanced power systems

- Short circuit calculation in balanced systems
- Unbalanced power system case study and vector representation
- Power transformer behavior in delta; open delta and star configuration
- Power flow circulation in unbalanced systems
- System short circuit condition in unbalanced systems

DAY TWO

Session 7: Power system transients caused by internal or external factors

- Substation bus protection
- Substation power transformer and reactor protection relays
- Substation feeder protection coordination
- Circuit breakers and reclosers

- Differential scheme acting on external factors
- Over-current relays acting on external or internal factors
- Differential protection of generator-transformer units
- Distance relays for backup power

Session 8: Power system transients caused by internal factors

- High inrush currents generated by magnetic core
- Switching power under load or no-load conditions
- Mutual induced current in adjacent circuits
- Traveling waves in electrical power transformers
- Ferro-resonance effects in power transformers
- Long line effects on substations
- Remote tripping of transformer banks
- Electrostatic and electromagnetic induction
- Differential and common mode transient compensation
- Capacitor switching systems
- Bus energization or deenergization
- Transmission line switching
- Coupling capacitor switching
- Reclosers as a source of system disturbance

Session 9: Compensation and mitigation of the electrical power system transients

- Separation principle applied to power systems
- Suppression systems at the source
- Suppression shielding, case study for power cables
- Control systems immunity from EMI and induced transients
- Correcting electric power quality to avoid spurious trips and nuisance alarms

Session 10: Overview of flow control of active and reactive power in electrical systems

- Capacitor bank protection
- Protecting solid state reactive power units
- Reactive power regulation and control
- Compensating for power factor at the industrial side

Session 11: Design consideration to obtain a robust power system

- Steady state stability
- Voltage stability and on load step condition
- Voltage stability for small disturbances
- Transient stability and recovery
- Voltage instability protection
- Intelligent load shedding

Session 12: Electrical protection design steps and factors to be considered

- Modeling a power system, data validation
- Short circuit analysis of a power system
- Analytical or software driven calculations
- Protection coordination - Time current curves
- Calibration and maintenance of protective equipment - relay calibration data sheets
- Test bench equipment for calibration and validation
- Codes and standards applicable to electrical power systems

Session 13: Case study of a complex power system protection design

- Using specialized software a complex power system will be analyzed

COURSE SCHEDULE

Both days:

Start: 8:00 a.m.
Coffee break: 10:00 a.m.
Lunch: 12:00 noon
Finish: 4:30 p.m.

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