

2009 WPRC Training Track

The subcommittee's proposal is to offer training sessions concurrently with paper sessions, beginning after the morning break on Tuesday, October 20. This will allow all conference attendees to be present for the opening general session.

A training session will consist of a block of time between breaks, so that one day would have four training sessions available:

8:00 a.m. – 10:10 a.m.

10:30 a.m. – 12:00 p.m.

1:15 p.m. – 2:40 p.m.

3:00 p.m. – 5:10 p.m.

Session I: 10:30 a.m. – 12:00 p.m. Tuesday October 20

General Introduction to Protection Engineering

J. Harshbarger, PSE

- What is needed of new protection engineers
- General philosophy of protection
- Objectives of protection engineering
- Power system components
- Measuring units
- Zones of protection
- Device numbers
- Three-phase power
- Phasors and polarity
- Per-unit

Session II: 1:15 p.m. – 2:40 p.m. Tuesday October 20

Basics of Protection

Roger Hedding, ABB

- Relay input sources
- Schematic diagrams
 - o AC
 - o DC

Session III: 3:00 p.m. – 5:10 p.m. Tuesday October 20

Symmetrical Components

Kenneth Workman, Schweitzer Engineering Labs

- Power System Fault Analysis
 - Balanced Faults Analysis
 - Understand the importance of analyzing system faults
 - Understand the power system equipment models and impedances
 - Understand short-circuit calculations: transient and steady-state analysis for balanced faults
 - a. Unbalanced Faults Analysis
 - i. Describe the method of symmetrical components and why they work
 - ii. Discuss sequence networks of power system components
 - 1. Sequence networks of lines
 - 2. Sequence networks of generators
 - 3. Sequence networks of transformers
 - iii. Discuss sequence network connections for unbalanced faults
 - iv. Graphical/Mathematical Exercises?

Session IV: 8:00 a.m. – 12:00 p.m. Wednesday October 21

Coordination of Overcurrent Protection in Radial Systems

Kenneth Workman, Schweitzer Engineering Labs

- II. Coordination of Overcurrent Protection in Radial Systems
 - a. Overcurrent element principles of operation
 - i. Discuss power system fuse characteristics
 - ii. Discuss instantaneous overcurrent element design
 - iii. Discuss inverse time-overcurrent element design
 - b. Coordination principles for radial systems
 - i. Discuss general coordination principles of overcurrent devices in distribution feeders
 - 1. Sensitivity
 - 2. Speed
 - 3. Security
 - 4. Selectivity
 - ii. Describe the principles and methods to coordinate fuses with overcurrent relays
 - 1. Fuse saving
 - 2. Non-fuse saving
 - iii. Describe the principles and methods to coordinate overcurrent relays
 - iv. Discuss coordination conflicts inherent to power systems
 - v. Discuss transformer high-side fusing considerations

Session VI: 1:15 p.m. – 2:40 p.m. Wednesday October 21

Differential protection

Mukesh Nagpal, BC Hydro

- Basic principles
- Bus differential
 - Low impedance
 - High impedance

Session VII: 3:00 p.m. – 5:10 p.m. Wednesday October 21

Differential protection (continued)

Mukesh Nagpal, BC Hydro

- Basic principles
- Transformer differential
 - Distribution Transformers (2-winding)
 - Autotransformers (3-winding)

Session VIII: 8:00 a.m. – 10:10 a.m. Thursday October 22

Line protection

Pui Lau, GE Digital Energy-Multilin

- Polarizing sources and Directionality
 - Current
 - Voltage
 - Positive, Negative and Zero Sequence

Session IX: 10:30 a.m. – 12:00 p.m. Thursday October 22

Line protection

Pui Lau, GE Digital Energy-Multilin

- Basics of line protection
 - Distance
 - Directional Ground

Session X: 1:15 p.m. – 2:40 p.m. Thursday October 22

Line protection

Pui Lau, GE Digital Energy-Multilin

- Distance and pilot schemes
 - STEP
 - POTT
 - DCB

Session XI: 3:00 p.m. – 5:10 p.m. Thursday October 22

Line protection

Roger Hedding, ABB

- Line differential protection