GLOBAL INDUSTRIES INTELLIGENCE

ADVANCED POWER SYSTEM PROTECTION MASTERCLASS

5 DAY TRAINING FOR UTILITY AND POWER PROFESSIONALS

20 - 24 May, 2024

Novotel Hotel, Dubai

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POWER SYSTEM PROTECTION MASTER CLASS:

· Designed for Utility and Power System Professionals.
· This is a generic seminar not focused on any particular protection relay manufacturer, product or product type.
· Taking attendees from a basic understanding of the elementary concepts and fundamental principles of
Power System Protection through to an in-depth and comprehensive understanding of Transmission,Power System Protection.

WHAT YOU WILL LEARN

This seminar is specifically designed to provide a comprehensive understanding of the principles of power system protection design. Via a progressive "building block" approach, this seminar proceeds from the basic concepts, such as security, reliability and duplication of power system protection through to a comprehensive consideration of protection of the transmission system and power station plant. Thus, this seminar is specifically designed to meet the learning requirements of those who presently have only a fundamental knowledge of protection principles,while, via a progressive approach, also considering more advanced topics to thus provide a valuable insight for those more experienced in the discipline of power system protection design. Hence, this seminar will assist both those whose day to day work involves them in the application of protection design, coordination and relay setting, and also those in less directly associated areas of
electricity system design

· The introductory material covers the basic principles of protection design, reliability, security and dependability as well as the implementation of unit and non-unit protection schemes, and remote, local and dead zone back-up schemes.

· With this grounding, delegates learn the principles of fault level calculation, including a comprehensive, but easily comprehendible discussion of sequence components.

· The first day will conclude with a consideration of the Time and Current coordination of IDMT Over Current and Earth Fault relays, considering also the application of directional functionality, Sensitive Earth Fault Protection, and the use and coordination of expulsion and HRC Fuses.

· Distance relay protection discussions cover fundamental design aspects, relay comparator characteristics and load transfer implications.

· Protection Signalling requirements, to meet regulatory requirements covers the fundamental principles of distance relay permissive PUTT and POTT schemes and blocking schemes as well as considering power line carrier applications.

· Specialized distance relay application aspects, including mutual coupling, teed feeder, Zone 3 back-up and Switch OnTo Fault (SOTF) logic are then discussed.

· Unit protection scheme discussions cover both the application of high impedance differential schemes and biased low impedance differential schemes. In considering the latter, with the specific application to transformer protection, the aspect of phase angle correction, zero sequence current correction, CT connection and the application of microprocessor-based relays is considered in detail. The special application of high and low impedance schemes to busbars is discussed. The application of unit protection to feeders covers the implementation of feeder current differential relays.

· The “Dead” and “Reclaim” time considerations of Auto reclosing schemes for both HV and distribution feeder systems are considered, including the application of single and three pole reclosing schemes to EHV systems, as well as safety considerations in relation to lower voltage reclosing schemes.

· The protection of Capacitor Bank installations, includes a considerations of inrush current implications, balance protection schemes, and the interaction with power station under excitation protection systems.

· And, finally, with a comprehensive consideration of generator protection, delegates will learn the principles of high speed protection for generator stator and rotor faults, while developing an appreciation for the philosophy of actually tripping as slowly as permissible when the generator is exposed to events which have long time implications.

SEMINAR PHILOSOPHY

Because of the progressive building block approach, this seminar will assist ...

- Both experienced and inexperienced protection design technicians and engineers.
- Those whose day to day work involves them in the application of protection design, coordination and relay setting.
- And also those in less directly associated areas of power system protection design.

WHO SHOULD ATTEND

This seminar has been prepared specifically to meet the requirements of:

- Protection Design Engineers, to identify protection implications and to ensure design, coordination and relay setting principles provide the necessary levels of speed, security, dependability and safety
- Planning Engineers, to identify the difficulties in providing protection for various power system configurations under review
- Maintenance Engineers, to ensure that system protection is not compromised as primary and/or secondary system plant is removed from service during maintenance
- Circuitry Design Engineers, to ensure that protective schemes are implemented in a manner to provide optimum performance
- Commissioning and Project Management Engineers, to ensure the actual field installation of the protection scheme and associated relay settings meets the design requirements

- Commissioning and Project Management Engineers, to ensure the actual field installation of the protection scheme and associated relay settings meets the design requirements
- Technicians, to understand the importance of their role in installing, testing and maintaining effective, reliable, dependable and secure protection systems

DAY 1

FUNDAMENTAL PRINCIPLES OF POWER SYSTEM PROTECTION

- Dependability and Security
- Speed of Protection
- Protection Zones & Overlap
- The "ART" of Protection
  - Unit Protection Principles
  - Non-Unit Protection Principles
- Redundancy and Duplication of protection
  - Duplicate Main Protection
  - Main and Local Back-up Protection
  - Main and Remote Back-up Protection
- CB Fail Protection and Blind Spot Protection

FAULT STUDIES AND SEQUENCE COMPONENTS

- Introduction to Fault Analysis
- Per Unit Methodology
- Classical Fault Study
- Sequence Components
- Three Phase faults
- Phase – Phase Faults
- Single Phase Faults
- Resistive Earth Faults
- Transformers and Sequence Networks

OVER CURRENT AND EARTH FAULT PROTECTION

- Time & Current Discrimination
- Relay Characteristics to IEC60255
- Coordination Procedure
- Instantaneous Elements
- Grading Margins
- Parallel Elements and OC Protection Grading
- Directional Relays
- Earth Fault Protection
- Sensitive Earth Fault Protection
- Fuses
- Fuse and Relay Coordination

DAY 2

INTRODUCTION TO DISTANCE PROTECTION

- Distance Zones, Time and Reach Coordination
- Primary and Secondary Impedances
- Simple Amplitude Comparators
- Impedance Circles
- Simple Angle Comparators
- Mho Circles
- Polarizing for Close-In Faults
- Zones of Protection – Circles and Quadrilaterals
- Three Phase Load Limit Performance
- Comparator Configurations for :
  - 3 Phase and Phase-Phase Faults
  - Earth Faults with Ko compensation

DISTANCE RELAY PROTECTION SIGNALLING

- Permissive Under Reach Transfer Tripping (PUTT)
- Permissive Over Reach Transfer Tripping (POTT)
- Blocking Intertripping
- DEF Intertripping
- PLC systems

ADVANCED APPLICATIONS OF DISTANCE PROTECTION

- Mutual Coupling
- Teed Feeders
  - DIT, PUTT, POTT and Blocking Applications

- Zone 3 Back-up Considerations
- Fault Resistance
- VT Supervision
- Polarizing for Close-in Faults and SOTF Logic
- Power Swing Blocking

DAY 3

FEEDER DIGITAL CURREN DIFFERENTIAL PROTECTION

- Data Synchronisation
- Conventional Biased Differential Systems
- Alpha Plane Systems
- 2, 3 and Multi Ended Systems
- Intertripping Schemes
- Back-Up Distance Relay Functionality

TRANSMISSION AND DISTRI-BUTION SYSTEM AUTO RECLOSING CONCEPTS

- Dead Time and Reclaim Time
- EHV Single and Three Pole Schemes
- Master/Slave Synchronism and Voltage Checks
- Distribution System Auto Reclosing
- Auto Reclosing Safety Considerations

PROTECTION OF CAPACITOR BANKS

- Over Current Protection and In-Rush Current Considerations
- Capacitor Can, Bank Components, and Design Considerations
- Balance Protection Schemes
- Over Voltage Protection

HIGH IMPEDANCE DIFFERETIAL PROTECTION (BUSBARS)

- HZ Differential Protection Principles
- Setting Principles
  - Setting Voltage for Through Fault Stability
  - CT Requirements for In-Zone Fault Detection
- Current Operated Relays with Stabilising Resistors
- Limiting HZ Protection Scheme Secondary System Voltages Safely
- Primary Operating Current
  - Application of Shunt Resistors
- Bus Zone Protection Check Systems
- CT Supervision Requirements
- High Impedance Differential Protection Schemes for other Galvanically (Electrically) Connected Plant

DAY 4

TRANSFORMER PROTECTION

- Buchholz and Pressure Relief Devices
- Bias Differential Basic Principles
- Stability under Magnetising Inrush Conditions
- Stability under Over Excitation Conditions
- Stability with Transformer Phase Shifts
- Stability under through Earth Fault Conditions
- Determination of Delta CT Connection
- Delta / Star Transformer Example
- Determination of CT Ratios
- Micro Processor Relay Implications
- Winding Neutral End Faults
  - Restricted Earth Fault Protection
- Zig-Zag Earthing Transformers
- Neutral Displacement Protection

LOW IMPEDANCE BUSBAR DIF-FERENTIAL PROTECTION

- Central and Bay Unit Designs
- Features to Accommodate Poor Quality CTs
- Multiple Zone Applications
- Allowance for Dynamic Switching of Plant
- Voltage and Check Zone Interlocking
- CB Fail and CB Fail Bus Trip Facilities
- Blind Spot Fault Facilities
- Multi Functionality

DAY 5 (HALF DAY)

GENERATOR PROTECTION GENERATOR FAULTS

- Generator Differential Protection Schemes
- Voltage Displacement Protection
- Stator Earth Fault Protection
(100%, 95% and 3rd harmonic schemes)
- Rotor Earth Fault Protection

GENERATOR EVENTS

- Stator Overload Protection
- Negative Phase Sequence (NPS) Protection
- Over Voltage and Over Excitation Protection
- Under Excitation Protection
- Reverse Power Protection
- Under and Over Frequency Protection
- Out of Step Protection

POWER SYSTEM PROTECTION TRAINING

PSPT is an ASIC (Australian Securities and Investment Commission) registered partnership, focusing specifically on the provision of professional development seminars in the discipline of Power System Protection.

ABOUT THE SEMINAR AUTHOR AND PRESENTER

Mr. Barrie Moor
Principal Engineer at Power System Protection Training, Australia

Experience:
39 years in the Queensland Electricity Transmission and Generation Supply Industries, including:
• 30 years in the discipline of Protection Design
• 25 years in Post Graduate Electricity Supply System Training

With 39 year's experience in the Queensland electricity supply industry, our principal engineer, the seminar author and presenter, Barrie Moor, was involved in the design, coordination and implementation of protection schemes associated with Queensland's HV and EHV transmission systems since 1981.

Barrie also has extensive experience with the protection of large generating plants having had responsibility for the protection of generators at many of Queensland's major power stations.

From 2000 to 2007, Barrie filled the role of Senior Engineer Protection Design, with statewide responsibility, leading Powerlink's Protection Design Team.

MR. BARRIE MOOR

Principal Engineer at Power System Protection Training, Australia

From 2007 to 2012, in the role of Principal Consultant Substation Protection, and then Principal Engineer Investigations, Barrie provided specialist Protection Design and Fault Analysis services to support the Asset Management and Operational Groups within Powerlink.

Barrie has 25 year's experience within Australia and internationally in the provision of university post graduate training on the design and implementation of HV and EHV Transmission Protection Systems and Power Station Generator Protection Systems.

Barrie has presented a number of papers on various specialized aspects of protection design at conferences both within Australia and internationally.

Barrie represented Powerlink on CIGRE committee APB5, “Power System Protection and Automation", and served as a corresponding member on Cigre and IEE working groups on Protection Systems.

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& Online on Zoom

FOR REGISTRATION PLEASE COMPLETE THIS FORM AND EMAIL BACK TO
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REGISTRATION FEE:

Book and Pay Before 4 April, 2024 @GBP 3995 per person
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