Modern Power System Protective Relaying

Date	Venues	($)Fees	Book your seat
25 Feb -29 Feb 2024	Kuala Lumpur	3300	Register Now

Introduction

Protection systems are installed to prevent faults from damaging electrical plant and to initiate isolation of faulted sections in order to maintain continuity of supply elsewhere on the system. Recent changes in technology together with changes in the manner in which Utilities and Industrial organisations operate, has greatly emphasized the development of integrated protection and control.

Modern relays include facilities such as monitoring and recording capabilities, self diagnostics and permit adjustment of setting by remote control. In short, the role of the modern protection relay is primarily to act in a fault situation but increasingly finds application in transmitting information in connection with the operation of the system. It is however the relay response to fault situations that forms the principal thrust of the current course.

This course will cover:

- Power System Fault Analysis
- Current and Voltage transformers
- Over Current and Earth Fault Protection
- Pilot Wire and Distance Protection
- Transformer, Generator and Motor Protection
- Busbar Protection
- Protection Settings and Grading

Objectives

Participants will gain a detailed appreciation of the following:

- The nature of different types of electrical faults and the effect these faults can have on company assets
- Understanding of electrical fault protection systems
- Practical solutions for specifying and operating protection systems
- Comprehensive understanding of principles and selection of protection relays and protection schemes
- The requirement for testing of relays and protection systems

Training Methodology

Each course participant will receive a copy of the comprehensive course notes. The presenter will outline and discuss the topics using computer displays, CD displays and Videotapes. The course is designed to have an interactive format to maximize delegate participation. Questions and answers are encouraged throughout and at the daily sessions. Needs-based case-studies and examples will be discussed in problem solving workshop sessions.

Organizational Impact

- The course will allow delegates to interact and gain from shared experiences of others
- Carefully selected examples and case studies will be used to illustrate the material being discussed
- Emphasis will be given to ensure that the material is appropriate to the organisations represented
- Understand the concept of protection system discrimination and appreciate its importance in improving security of supply
- An awareness and understanding of the modern power system protective relays and understand their basic operation

Personal Impact

- Understand the electrical characteristics of various electrical faults
- Identify different types of protection systems, understand the purpose of each type of protection system and identify the zone of protection for a given relay
- Recognize modern protective relays and understand their basic operation
- Appreciate the characteristics and importance of voltage transformers and current transformers in achieving dependable and accurate electrical protection systems
- Be familiar with the requirements for testing of protection systems

Who Should Attend?

- Engineers and Senior Technicians from Electrical Utilization Companies and Industrial organisations
- Building and Services Professionals, who have to deal with the aspects of electrical and industrial power systems protection, control and operation will also find the course beneficial. Participants need no specific requirements other than good understanding of electro technology and some relevant experience.

SEMINAR OUTLINE

DAY 1

Introduction to the Training

Introduction to Protection

- Protection Role
- Protection Objectives
- Protection Requirements
- Protection Basic Principles
- Protection Types
- Protection Function Codes
- Relay Protection History
- Numerical Protective Relays

Power System Fault Analysis

- Power System Basics
- Faults in Power Systems
- Type of Faults
- Balanced & Unbalanced Faults
- Fault Effects on the Power System
- Fault Current
- Factors Affecting a Fault
- Power System Analysis
- Short Circuit Calculation Method
- Three-Phase Fault
- Earth Fault

- Two-Phase Fault
- Open Circuit
- Modeling Components
- Short Circuit Calculation Procedure
- SC Calculations by Computer Program

DAY 2

Review of the Previous Work

Current and Voltage Transformers

- Current Transformers Theory
- Current Transformer Types
- Current Transformer Rated Characteristics
- Accuracy Class & CT Errors
- CT Magnetizing Curve
- CT Response To System Transients
- Current Transformers Earthing
- Current Transformer Connections
- Protection Requirements on CT
- Voltage Transformers Theory
- Voltage Transformer Types
- Voltage transformer rated characteristics
- VT accuracy & VT errors
- Effects on VT Performance
- Voltage Transformers Earthing
- Voltage Transformer Connections
- Optical Sensors Basics
- Optical Sensors Principle
- Optical Sensors Characteristics

Power System Earthing

- Purpose of Earthing
- System Earthing Types
- Forming Neutral Point in Isolated Systems

Circuit Breakers

- Purpose of Circuit Breakers
- Circuit Breaker Types (HV, MV, LV)
- Circuit Breaker Tripping Characteristics

Overcurrent Protection

- OC Protection Principle of Operation
- OC Protection Requirements
- OC Protection Characteristics
- Directional OC protection
- OC Typical Data
- OC Protection Applications

Earth Fault Protection

- EF Protection Principle of Operation
- EF Protection Requirements
- EF Protection Characteristics
- EF Protection Typical Data
- EF Protection Applications

- Numerical Multifunctional OC & EF Relays

DAY 3

Review of the Previous Work

Feeder Protection

- Feeders in Power Systems
- Pilot Wire Protection
- Pilot Wire Protection Schematics
- Pilot Wire Protection Characteristics
- Feeder Differential Protection
- Phase Angle Comparison
- Optical Differential Protection
- Communication Channels
- Feeder Diff Protection Characteristics
- Distance protection
- Distance protection zones & characteristics
- Distance protection schemes
- Distance protection issues
- Numerical distance protection

Transformer Protection

- Transformers in Power Systems
- Transformer Faults & Current Flow
- Magnetizing Inrush Current
- Transformer Protection Requirements
- Transformer Protection Concept
- Transformer Differential Protection
- Restricted Earth Fault Protection
- HV/LV Connections Protection
- HV overcurrent protection
- LV overcurrent & earth fault protection
- Neutral earth fault protection
- Transformer Mechanical Protection
- Transformer Tripping Circuits
- Earthing Transformer Protection
- Numerical Protection for Transformers
- Transformer Feeders Protection
- Ferroresonance, detection and mitigating measures

DAY 4

Review of the Previous Work

Generator Protection

- Generator Principle of Operation & Types
- Generator Earthing
- Generator Connections
- Generator Faults
- Generator Protection Requirements
- Generator Protection Concept
- Generator Mechanical Protection
- Shaft Protection
- Reverse Power Protection
- Pole Slipping Protection

- Generator Differential Protection
- Stator Earth Fault Protection
- Overcurrent Protection
- Stator Thermal Protection
- Rotor Earth Fault Protection
- Over Excitation Protection
- Unbalanced Load Protection
- Overvoltage Protection
- Undervoltage Protection
- Frequency Protection
- Forward Power Protection
- Generator Protection Summary

Motor Protection

- Motor Types
- Motor Principle of Operation
- Motor Considerations and Imposed External Conditions
- Motor Faults
- Motor Protection Requirements
- Motor Differential protection
- Overcurrent protection
- Overload protection
- Underload protection
- Earth fault protection
- Under-voltage protection
- Unbalanced protection
- Successive start protection
- Speed variation protection
- Loss of supply protection
- Out of synchronism protection
- Motor Protection Summary
- Numerical Motor Protection

DAY 5

Review of the Previous Work

Busbar Protection

- Busbars In Power Systems
- Busbar Protection Basics
- MV Busbar Protection
- High Impedance BB Protection
- Low Impedance BB Protection
- Numerical BB Protection
- Breaker Fail Protection

Protection Settings

- Protection Settings Calculations
- General Principles for Protection Settings
- Relay Configuration File Example
- Managing Protection Settings
- Over current Protection Setting Calculations
- Transformer Differential Protection Setting Calculations
- Distance Protection Setting Calculations

Protection Grading

- Protection Time-based Grading
- Current-based Grading
- Logic-based Grading
- Case Study for Time Based Grading of OC Protection

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