



Training Course:

Modern Power System Protective Relaying

Training Course For One Week In

UK - London - Marriott Hotel
Marble Arch



Which Be Held As Under Details :

- 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

Course Outline

Day1 - Introduction to the Training

Introduction to Protection

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

Power System Fault Analysis

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|---------------------------------------|-------------------------------------|
| – 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 | Modelling Components |
| – Short Circuit Calculation Procedure | SC Calculations by Computer Program |

Day2 - Review of the Previous Work

Current and Voltage Transformers

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|---|----------------------------|
| – Current Transformers Theory | Current Transformer Types |
| – Current Transformer Rated Characteristics | Accuracy Class & CT Errors |

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

Power System Earthing

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

Circuit Breakers

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

Overcurrent Protection

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

Earth Fault Protection

- EF Protection Principle of Operation
- EF Protection Characteristics
- EF Protection Applications
- EF Protection Requirements
- EF Protection Typical Data
- Numerical Multifunctional OC & EF Relays

Day3 - Review of the Previous Work

Feeder Protection

- Feeders in Power Systems
- Pilot Wire Protection Schematics
- Feeder Differential Protection
- Optical Differential Protection
- Pilot Wire Protection
- Pilot Wire Protection Characteristics
- Phase Angle Comparison
- Communication Channels

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- 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

Day4 - 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

Day5 - 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
- Overcurrent 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

Training Summary

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