XCELERATE TRAINING INSTITUTE

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ELECTRICAL ENGINEERING

Modern Power System Analysis and Protective Relaying Training Course

DURATION	LANGUAGE	FORMAT
10 days	**English**	**Classroom / Online**

Upcoming dates

Dates	Venue	Format	Fee
12 – 23 Apr 2027	Live online	Online (live)	**€1,800**
18 – 29 Oct 2027	Live online	Online (live)	**€1,800**
15 – 26 Nov 2027	Casablanca	Classroom	**€7,200**

Register or ask a question

Online: x8ti.com/course/modern-power-system-analysis-and-protective-relaying…

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Modern Power System Analysis and Protective Relaying Training Course

Introduction

The safety of low, medium, and high voltage power systems requires understanding system faults, detecting them, and ensuring their protected disconnection from the power grid. This course provides a comprehensive overview of the theories, principles, and applications of protection schemes for various power system elements, including feeders, transformers, motors, buses, and generators.

It explores power system faults and the requirements for protection schemes to detect and manage these faults. The course covers practical aspects such as testing and coordination of protection systems and is tailored for industries and utility corporations reliant on proper system protection for operational efficiency.

Learning Objectives

Upon completing this Modern Power System Analysis and Protective Relaying course by Xcelerate Training institute, participants will be able to:

- Understand operational principles and types of electrical protection.
- Study the design of various types of relays.
- Select appropriate protection relays and related devices.
- Develop and analyze typical power systems and associated protection systems.
- Design protection schemes.
- Analyze numerical relay protection for generators, transformers, motors, and transmission lines.
- Establish communication between protection devices and controllers.
- Identify motor faults and protect them from hazards.
- Determine fault levels and loadings of feeders and branches.

Training Methodology

This collaborative training program includes:

- Lectures
- Seminars & Presentations
- Group Discussions
- Assignments
- Case Studies & Functional Exercises Following the ‘Do-Review-Learn-Apply’ model.

Benefits for Your Organisation

Organizations can benefit from:

- Ensuring a workable selection of protection functions and relay types for different operational scenarios.
- Executing effective relay protection settings for separate zones.
- Developing a structured method and understanding of key protection schemes.

- Confirming safe operation of electrical equipment and installations.
- Familiarity with testing and measuring instruments.
- Computing fault levels and potential fault current in transformers.

Benefits for You

Participants will gain:

- Expertise in power system analysis, including load and fault studies.
- Understanding of the role of protective relaying.
- Knowledge of theoretical concepts and practical equations of power system protection.
- Ability to perform analysis and design of protection logic and schemes.
- Skills to evaluate relay functions, applications, and coordination.
- Recognition of the complexity of power system switching and operation, with proposed solutions for protection.
- Enhanced skills for further qualifications in the field of modern power system analysis and protective relaying.

Who Should Attend

This course is ideal for:

- System Operators
- Project Engineers
- Design Engineers
- Asset Engineers
- Project Managers
- Planning Engineers
- Planning Managers
- Electrical Engineers
- Electrical Technicians
- Asset Managers
- Commissioning Engineers and Technicians
- Protection and Instrumentation Engineers

Course Outline

Power System and Electrical Equipment Introduction

- Basic concepts of electrical engineering
- Three-phase power systems
- Voltage levels (low/medium/high)
- One-line and three-line diagrams
- Generation system layout
- Transmission system layout
- Substation system layout

- Distribution system layout
- Industrial switchgear
- Switchgear and protection functions

Electrical Power System Faults

- Types of faults
- Incidence of faults on power system equipment
- Effects of power system faults
- Magnitude of fault current
- Short circuit current calculation
- Positive, negative, and zero sequence systems
- Fault detection
- Fault clearance
- Requirements of protective relaying systems
- Electrical equipment damage curves

Coordination of Electrical Protection Systems

- Circuit breaker to fuse coordination
- Fuse to circuit breaker coordination
- Software packages for protection coordination studies
- Auto-reclosing of circuit breakers
- Backup protection
- Fault current limitation
- Selective zones of protection

Components of Power System Protection Schemes

- Historical fault detecting relays
- Tripping relays and auxiliary relays
- Circuit breakers
- Microprocessor-based relays
- Modern protective relaying case studies
- Types of CTs, VTs, and CVTs
- CT theory and characteristics
- CT application requirements for protective relaying
- Accuracy classifications
- Testing of CTs and VTs

Motor Protection, Starting, and Control

- Applicable motor standards
- Starting methods
- Differential protection, phase unbalance, overcurrent
- Ground fault protection
- Microprocessor-based motor control and protection devices

Protective Devices and Earthing Systems

- Protection zones and time-current characteristic curves
- Fuse types, applications, selection, and coordination
- Digital and numerical relay functionalities
- Ungrounded vs. grounded systems

Feeder Overcurrent and Earth Fault Protection

- Feeder protection merits and characteristics
- IDMT O/C & E/F protection
- Definite time (DT) protection
- High-set instantaneous protection
- Transient overreach
- Relay settings

Transformer Digital and Differential Protection

- Transformer protection
- Transformer unit protection
- Buchholz and pressure relief operations
- Complexities and solutions in transformer differential protection
- Unit and non-unit transformer protection
- Digital transformer protection systems

Generator Protection

- Over-frequency, underfrequency, overvoltage, undervoltage protection
- Negative phase sequence or phase unbalance
- Voltage controlled and voltage restricted overcurrent protection
- Synchronizing systems and synchro-check relays
- Comparison of electromechanical and electronic relays
- Testing generator protection schemes
- Microprocessor-based multi-function generator protection relays
- Interpreting generator capability curves

Directional Protection and Capability Curve

- Faults and protection features
- Protection overview
- Differential protection
- Overall protection
- Full protection with numerical relays

Busbar Protection and Distance Protection for Overhead Lines

- Digital busbar protection schemes
- High impedance busbar protection
- Frame leakage protection

- Line distance protection
- Line differential protection

Cogeneration and Non-Utility Generation (NUG) Protection

- Non-utility generating stations
- NUG interconnection to utility power systems
- Typical protection schemes for NUGs
- Low-cost multi-function relays for small generators
- Breaker failure protection
- Testing utility tie protection schemes

Transmission Line Protection

- Distance or impedance protection schemes
- Phase comparison protection schemes
- Communication channel requirements between terminals
- Coordination and transfer-tripping between terminals

Capacitor Protection

- Static capacitor applications in power systems
- Protection schemes for capacitors
- Testing capacitor protection schemes
- Microprocessor-based capacitor protection and controls relays

Latest Developments and Future Trends in Protective Relaying

- Digital relays
- Integrated microprocessor-based systems for protective relaying
- Optical current transformers
- Fiber optic communications

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Registration Form

Modern Power System Analysis and Protective Relaying Training Course

Preferred dates: ..... Venue or online: .....

Duration: 10 days Language: .....

Please complete and email this form to us, or register online. We confirm your place and send the invoice within one working day.

Delegate information

Full name (Mr / Ms / Dr / Eng): .....

Position: ..... Telephone / mobile: .....

Official email: ..... Personal email: .....

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Person responsible for training & development

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