Training Course on Advanced Power System Protection and Relay Coordination

Professional Development Training Course Outline

Category	Engineering	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Introduction

As modern power systems evolve with increasing complexity, high integration of renewables, and rising automation, advanced power system protection becomes paramount to ensure system reliability, continuity, and safety. Training Course on Advanced Power System Protection and Relay Coordination provides in-depth technical knowledge and practical skills in relay coordination, fault detection, digital protection schemes, and grid resilience strategies. Participants will explore the latest advancements in numerical relays, IEC 61850 communication protocols, and adaptive protection systems.

Designed for electrical engineers, utility professionals, and protection specialists, this course emphasizes real-time fault analysis, substation automation, and smart grid protection challenges. Through interactive modules, hands-on simulations, and global case studies, participants will gain expertise in designing robust protection schemes that align with the future of digital substations, microgrids, and renewable energy systems.

Programme Curriculum

Training Course on Advanced Power System Protection and Relay Coordination

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Course Objectives

1. Understand principles of advanced power system protection
2. Analyze various types of electrical faults and fault current behavior
3. Design and coordinate protection relays in transmission and distribution systems
4. Differentiate between electromechanical, static, and numerical relays
5. Apply IEC 61850 and communication-based protection systems
6. Model protection schemes using simulation tools like ETAP and DigSILENT PowerFactory
7. Implement directional overcurrent and distance protection techniques
8. Optimize relay settings for minimal tripping and selectivity
9. Integrate protection schemes with SCADA and substation automation
10. Evaluate protection requirements in renewable and distributed energy resources
11. Address cybersecurity risks in modern protection systems
12. Perform root-cause analysis of protection system failures
13. Review case studies on blackouts and protection miscoordination

Organizational Benefits

1. Enhanced grid reliability and stability
2. Reduced downtime from accurate fault isolation
3. Optimized protection investment with effective relay settings
4. Faster restoration during outages
5. Improved safety of personnel and equipment
6. Compliance with modern utility and grid codes
7. Efficient integration of renewables and distributed generation
8. Advanced diagnostic capability and incident response
9. Increased workforce competence in modern protection systems
10. Reduced operational risks and equipment damage

Target Participants

- Protection and control engineers
- Substation and SCADA engineers

- Transmission and distribution planners
- Electrical utility professionals
- Industrial electrical maintenance teams
- Renewable energy project developers
- Energy auditors and consultants

Course Outline

Module 1: Fundamentals of Power System Protection

1. Objectives of protection systems
2. Types of faults and fault detection
3. Zones of protection
4. Protective relay characteristics
5. Case Study: Blackout due to relay misoperation in India

Module 2: Protection Relays – Types and Technologies

1. Electromechanical relays
2. Static and solid-state relays
3. Numerical relays
4. Relay construction and operation
5. Case Study: Relay evolution in the US power grid

Module 3: Overcurrent Protection

1. Instantaneous and time-delayed characteristics
2. Inverse time characteristics (IDMT curves)
3. Coordination of overcurrent relays
4. Phase and ground fault protection
5. Case Study: Industrial plant protection optimization

Module 4: Distance and Impedance Protection

1. Fundamentals of distance protection
2. Zones of protection in transmission lines
3. Relay settings and reach
4. Quadrilateral and mho characteristics
5. Case Study: Distance protection in high-voltage lines

Module 5: Differential Protection Schemes

1. Principle of differential protection
2. Transformer differential protection
3. Busbar and generator protection
4. Current transformers and saturation issues
5. Case Study: Transformer protection failure investigation

Module 6: Directional Protection and Load Encroachment

1. Need for directional protection
2. Relay polarizing techniques
3. Load encroachment and fault discrimination
4. Negative-sequence current applications
5. Case Study: Long radial feeder protection

Module 7: Feeder Protection Systems

1. Radial and looped feeder protection

2. Fuse and recloser coordination
3. Sectionalizers and automation
4. Arc flash protection considerations
5. Case Study: Urban distribution network protection

Module 8: Generator and Motor Protection

1. Rotor and stator fault protection
2. Overload and overtemperature protection
3. Protection of synchronous machines
4. Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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