



External Training Course

Electrical Distribution Systems

From 20 Oct. To 24 Oct. 2025
From 24 Nov. To 28 Nov. 2025
From 15 Dec. To 19 Dec. 2025

**Marriot Marble Arch Hotel,
London, UK**

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Course Overview

This comprehensive 5-day training program provides participants with a solid and practical understanding of Electrical Distribution Systems — from design principles and system components to operation, protection, and modern automation. The course presents an integrated approach to the planning, analysis, and management of low- and medium-voltage distribution networks used in industrial facilities, utilities, and smart infrastructure. Through a mix of theoretical sessions, engineering calculations, and real-world case studies, participants will develop the knowledge and skills necessary to design efficient, reliable, and cost-effective electrical distribution systems that meet modern power quality and reliability standards.

Course Objectives

By the end of this course, participants will be able to:

- Understand the structure, components, and configurations of electrical distribution systems.
- Analyze and design distribution feeders, substations, and transformers for optimal performance.
- Calculate voltage drops, power losses, and load flows within various network layouts.
- Apply effective methods for voltage regulation and reactive power compensation.
- Evaluate and improve system reliability and power quality.
- Implement protection schemes and select appropriate protective devices.
- Utilize automation and SCADA systems for monitoring and control.
- Integrate distributed generation and renewable energy sources into existing networks.
- Develop strategies to optimize efficiency, safety, and sustainability in distribution operations.

Target Audience

This course is specifically designed for:

- Electrical, power, and design engineers.
- Utility engineers and maintenance personnel.
- Plant electrical supervisors and project engineers.
- Consultants and technical professionals in power systems.
- Engineers involved in network design, load analysis, and protection coordination.
- Energy auditors, reliability engineers, and technical trainers.

Training Methodology

The program combines interactive lectures, analytical exercises, and case studies to ensure effective learning. Training methods include:

- Instructor-led presentations with illustrated diagrams.
- Practical calculation workshops and software demonstrations.
- Real case studies from utilities and industrial networks.
- Group discussions and problem-solving exercises.
- Illustrated technical manuals and best-practice guidelines for reference.

Organizational Impact

Upon completion, participating organizations will benefit through:

- Improved system reliability and operational efficiency.
- Reduced power losses and enhanced voltage regulation.
- Optimized equipment performance and reduced maintenance costs.
- Strengthened technical expertise within engineering teams.
- Better planning for future system expansion and modernization.
- Enhanced compliance with power quality and safety standards.

Personal Impact

Participants will:

- Strengthen their technical skills in distribution design and operation.
- Gain hands-on experience in analyzing and optimizing real systems.
- Develop expertise in protection coordination and automation.
- Learn advanced diagnostic, monitoring, and optimization techniques.
- Build confidence to solve complex field and design challenges.
- Gain updated knowledge aligned with international engineering practices.

Course Content & Outline

Day 1 – Overview & Fundamentals of Electrical Distribution Systems

- Introduction to the electric power system: generation, transmission, and distribution.
- Role and importance of distribution systems in the power supply chain.
- Classification of distribution systems: radial, loop, network, and ring main.
- Key components: feeders, substations, transformers, service mains, and distribution cables.
- Load characteristics and demand patterns.
- Standards, codes, and safety practices in distribution engineering.
- Case study: Comparison between industrial and utility distribution systems.

Day 2 – Feeder Design, Load Analysis & Transformer Applications

- Distribution feeder configurations and conductor selection criteria.
- Voltage drop and line loss calculations.
- Load estimation, diversity and coincidence factors, and demand profiles.
- Transformer selection, connection methods, and voltage regulation.
- Load balancing and phase current management.
- Energy loss reduction and efficiency improvement.
- Workshop: Load flow and voltage profile calculation for a sample feeder.

Day 3 – Power Quality, Voltage Control & Reactive Compensation

- Definition and importance of power quality in distribution networks.
- Common power quality issues: harmonics, flicker, unbalance, sags, and swells.
- Voltage control methods: tap changers, voltage regulators, and capacitor banks.
- Power factor correction and reactive power management.
- Selection and placement of shunt capacitors.
- Harmonic filtering and mitigation methods.
- Case study: Improving power factor and voltage profile in an industrial network.

Day 4 – System Protection, Reliability & Automation

- Protection principles and device coordination in distribution systems.
- Types of protective devices: fuses, relays, circuit breakers, reclosers, and isolators.
- Fault detection, isolation, and service restoration.
- Reliability indices: SAIFI, SAIDI, CAIDI, and system availability.
- Reliability-centered maintenance (RCM) strategies.
- SCADA, monitoring systems, and remote control.
- Distribution automation and intelligent grid technologies.
- Workshop: Coordination study and fault analysis exercise.

Day 5 – Modern Trends, Smart Grids & Optimization Strategies

- Distributed generation (DG) and renewable integration.
- Microgrids and energy storage in distribution systems.
- Smart grid technologies and digital substations.
- Communication networks and data analytics for distribution systems.
- Planning, expansion, and system optimization methodologies.
- Economic and environmental considerations in modern networks.
- Case study: Design of a smart distribution system with DG integration.
- Final group workshop and assessment session.

Course Agenda:

(1st Day) Agenda

8.30	9.00	Opening Remarks (30 Min.).
9.00	11.30	<u>Overview & Fundamentals of Electrical Distribution Systems:</u> • Introduction to the electric power system: generation, transmission, and distribution. • Role and importance of distribution systems in the power supply chain. • Classification of distribution systems: radial, loop, network, and ring main. • Key components: feeders, substations, transformers, service mains, and distribution cables.
11.30	12.00	Coffee Break
12.00	14.00	<u>Overview & Fundamentals of Electrical Distribution Systems:</u> • Load characteristics and demand patterns. • Standards, codes, and safety practices in distribution engineering. • Case study: Comparison between industrial and utility distribution systems.
14.00	14.30	Questions and Discussion
14.30		Buffet Lunch

(2nd Day) Agenda

9.00	11.30	<u>Feeder Design, Load Analysis & Transformer Applications:</u> • Distribution feeder configurations and conductor selection criteria. • Voltage drop and line loss calculations. • Load estimation, diversity and coincidence factors, and demand profiles. • Transformer selection, connection methods, and voltage regulation.
11.30	12.00	Coffee Break
12.00	14.00	<u>Feeder Design, Load Analysis & Transformer Applications:</u> • Load balancing and phase current management. • Energy loss reduction and efficiency improvement. • Workshop: Load flow and voltage profile calculation for a sample feeder.
14.00	14.30	Questions and Discussion
14.30		Buffet Lunch

(3rd Day) Agenda

9.00	11.30	<u>Power Quality, Voltage Control & Reactive Compensation:</u> • Definition and importance of power quality in distribution networks. • Common power quality issues: harmonics, flicker, unbalance, sags, and swells. • Voltage control methods: tap changers, voltage regulators, and capacitor banks. • Power factor correction and reactive power management.
11.30	12.00	Coffee Break
12.00	14.00	<u>Power Quality, Voltage Control & Reactive Compensation:</u> • Selection and placement of shunt capacitors. • Harmonic filtering and mitigation methods. • Case study: Improving power factor and voltage profile in an industrial network.
14.00	14.30	Questions and Discussion
14.30		Buffet Lunch

(4th Day) Agenda

9.00	11.30	<u>System Protection, Reliability & Automation:</u> • Protection principles and device coordination in distribution systems. • Types of protective devices: fuses, relays, circuit breakers, reclosers, and isolators. • Fault detection, isolation, and service restoration. • Reliability indices: SAIFI, SAIDI, CAIDI, and system availability.
11.30	12.00	Coffee Break
12.00	14.00	<u>System Protection, Reliability & Automation:</u> • Reliability-centered maintenance (RCM) strategies. • SCADA, monitoring systems, and remote control. • Distribution automation and intelligent grid technologies. • Workshop: Coordination study and fault analysis exercise.
14.00	14.30	Questions and Discussion
14.30		Buffet Lunch

(5th Day) Agenda

9.00	11.30	<u>Modern Trends, Smart Grids & Optimization Strategies:</u> • Distributed generation (DG) and renewable integration. • Microgrids and energy storage in distribution systems. • Smart grid technologies and digital substations. • Communication networks and data analytics for distribution systems.
11.30	12.00	Coffee Break
12.00	14.00	<u>Modern Trends, Smart Grids & Optimization Strategies:</u> • Planning, expansion, and system optimization methodologies. • Economic and environmental considerations in modern networks. • Case study: Design of a smart distribution system with DG integration. • Final group workshop and assessment session.
14.00	14.30	Questions, Discussion & Conclusion Training Course.
14.30		Buffet Lunch