Power Quality Analysis and Harmonic Mitigation Solutions Training Course



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4100 € (Per Person)

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Course Introduction / Overview:

This comprehensive training course provides an in-depth exploration of power quality phenomena and effective harmonic mitigation strategies essential for modern electrical systems. In an era where sensitive electronic loads and non-linear devices are ubiquitous, maintaining a clean and stable power supply is paramount to operational efficiency and equipment longevity. This program, offered by BIG BEN Training Center, is meticulously designed to bridge the gap between theoretical knowledge and practical application. Participants will delve into the core principles of power quality, learning to identify, analyze, and solve common issues such as voltage sags, swells, transients, and harmonic distortion. The curriculum is informed by the foundational work of leading experts like Roger C. Dugan, a key author of the seminal text "Electrical Power Systems Quality". By examining the principles outlined by Roger C. Dugan, attendees will gain a robust understanding of the causes and effects of power disturbances. The course emphasizes a hands-on approach to problem-solving, equipping professionals with the skills to implement corrective measures, from passive filters to advanced active harmonic filters, ensuring compliance with international standards like IEEE 519 and enhancing overall system reliability.

Target Audience / This training course is suitable for:

- Electrical Engineers and Technicians.
- Power System Operators and Planners.
- Maintenance and Operations Supervisors.
- Facility Managers.
- Industrial Plant Engineers.
- Consulting Engineers.
- Project Managers in the energy sector.
- Renewable Energy System Designers.
- Quality Control and Assurance Professionals.
- Research and Development Specialists in power electronics.

Target Sectors and Industries:

- Manufacturing and Industrial Plants.
- Power Generation and Distribution Utilities.
- Oil and Gas Sector.
- Data Centers and IT Infrastructure.
- Healthcare and Medical Facilities.
- Commercial Buildings and Real Estate Management.
- Telecommunications.
- Transportation and Railway Systems.
- Governmental bodies and regulatory agencies.
- Renewable Energy (Solar and Wind Farms).

Target Organizations Departments:

- Engineering and Design.
- Operations and Maintenance.
- Facilities Management.
- Technical Services.
- Planning and Development.
- Quality Assurance and Control.
- Health, Safety, and Environment (HSE).
- Project Management.
- Research and Development.
- Grid Operations and Control.

Course Offerings:

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

- Identify the fundamental parameters of power quality.
- Analyze the sources and impacts of harmonic distortion in power systems.
- Measure and interpret power quality data using monitoring equipment.
- Apply IEEE 519 standards for harmonic control.
- Design and implement effective passive and active harmonic filters.
- Develop strategies for mitigating voltage sags, swells, and transients.
- Evaluate the impact of non-linear loads on electrical networks.
- Perform power factor correction analysis and implement solutions.
- Troubleshoot complex power quality problems in industrial and commercial settings.
- Enhance electrical system reliability and efficiency through targeted interventions.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to foster a dynamic and engaging learning environment that promotes deep understanding and practical skill acquisition. This course moves beyond traditional lectures by integrating a blend of interactive presentations, expert-led discussions, and collaborative group activities. A significant emphasis is placed on real-world case studies, where participants will analyze actual power quality problems and dissect successful mitigation projects. This practical approach allows attendees to connect theoretical concepts to tangible industrial challenges. The training incorporates simulation exercises and workshops where participants can apply diagnostic techniques and model the effects of different mitigation solutions. Our experienced instructors facilitate an open and interactive atmosphere, encouraging participants to share their own professional experiences and challenges, creating a rich peer-to-peer learning opportunity. Continuous feedback is provided throughout the sessions to ensure concepts are fully grasped. The program is structured to ensure that by its conclusion, every participant not only understands the principles of power quality but is also confident in their ability to apply these skills directly to their work environment, thereby delivering immediate value to their organization.

Course Agenda (Course Units):

Unit One Introduction to Power Quality Fundamentals

- Defining power quality and its importance in modern systems.
- Understanding key power quality parameters like voltage, frequency, and waveform.
- Common power quality terminology and definitions.
- Sources of power quality disturbances.
- The economic impact of poor power quality on industrial and commercial facilities.
- Introduction to international standards and regulations (IEC, IEEE).
- The role of grounding and bonding in maintaining power quality.

Unit Two Harmonic Distortion Analysis and Sources

- Understanding harmonics and their origins.
- Analyzing non-linear loads such as VFDs, SMPS, and LED lighting.
- Calculating Total Harmonic Distortion (THD) and its significance.
- The effects of harmonics on transformers, motors, and cables.
- Harmonic resonance phenomena in power systems.
- Introduction to Fourier analysis for waveform decomposition.
- Case studies of harmonic-related equipment failure.

Unit Three Power Quality Disturbances and Monitoring

- Investigating voltage sags, swells, and interruptions.
- Understanding transients, impulses, and notches.
- Analyzing voltage flicker and its causes.
- Principles of power quality monitoring and data acquisition.
- Selecting and deploying power quality analyzers.
- Interpreting monitoring data, waveforms, and event logs.
- Techniques for long-term power quality assessment and benchmarking.

Unit Four Harmonic Mitigation and Filtering Techniques

- Overview of harmonic mitigation strategies.
- Design and application of passive harmonic filters (tuned and broadband).
- Principles and advantages of active harmonic filters.
- Application of hybrid filters for complex load scenarios.
- Detuned capacitor banks for power factor correction and harmonic control.
- Line reactors and drive isolation transformers.
- Best practices for system design to minimize harmonic generation.

Unit Five Advanced Mitigation and System-Level Solutions

- Implementing effective power factor correction strategies.
- Solutions for mitigating voltage sags and swells, including DVR and STATCOM.
- Transient voltage surge suppression (TVSS) techniques.
- Addressing grounding issues and electrical noise.
- Conducting a comprehensive power quality audit.
- Developing a site-wide power quality improvement plan.
- Future trends and challenges in power quality with renewable energy integration.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

As renewable energy sources like solar and wind become more integrated into the grid, what new and unforeseen power quality challenges might arise, and how might traditional harmonic mitigation strategies need to evolve to address them?

What unique qualities does this course offer compared to other courses?

This training course distinguishes itself by moving beyond purely theoretical discussions to offer a deeply practical and solution-oriented curriculum. While other programs may focus heavily on diagnostics, our course dedicates significant time to the design, selection, and implementation of real-world mitigation strategies, from passive filters to advanced active solutions. The content is rigorously aligned with current industry challenges and international standards, particularly IEEE 519, ensuring that the skills learned are immediately applicable and compliant. We emphasize a holistic approach, teaching participants not just how to fix a single problem but how to conduct a comprehensive power quality audit and develop a system-wide improvement plan. The integration of case studies from diverse sectors—including manufacturing, data centers, and renewable energy—provides a broad perspective that is often missing from more narrowly focused courses. Our methodology encourages interactive problem-solving, allowing participants to analyze complex scenarios and debate the merits of various corrective actions, thereby honing their critical thinking and decision-making abilities in a way that passive learning cannot. This focus on practical application and strategic thinking equips professionals with the robust expertise needed to ensure electrical system reliability and efficiency.