



Power Quality and Harmonics

Course Introduction:

The Power Quality and Harmonics course combines extensive study experience to familiarize attendees with the terminology and concepts to evaluate power quality. The course reviews the causes of various types of power quality problems in commercial and industrial environments. The effect of these problems on power system components and end-user equipment will also be addressed. Commercially-available tools for identifying these problems will be discussed and demonstrated, as well as how to interpret their results.

The effects of harmonics on various power system components and methods of reducing excessive harmonics will also be addressed. IEEE recommendations, National Electric Code requirements are also emphasized in this course.

Mitigation techniques for power quality problems will be studied, including the use of K-factor rated transformers, full neutrals and harmonic filters. The operational principles of uninterruptible power supplies will be discussed along with consideration for their sizing and applications. Other emergency back-up systems will also be addressed.

At the end of the course the attendees would gain good knowledge and skills to deal with power quality and harmonics problems. The attendees would be aware of the new trends in monitoring and solving these problems. Thus, they would participate in increasing the level of the electric network reliability, and reduce liability of the outage of the electric power service.

Course Objectives:

Upon completion of this course, attendees will be able to:

- Understand the causes of various types of power quality problems in commercial and industrial environments
- Recognize the cause and source of power system disturbances.
- Define the various equipment's used for power monitoring.
- Know how to mitigate any existing and potential problems, thereby minimizing equipment disoperation and process downtime.
- Analyze types of electrical systems loads and their power quality considerations.
- Calculate harmonic voltages and currents

Organizational Impact:

Attendees will have new knowledge and techniques about power quality and harmonics in electric power systems. This will allow them to understand and implement the requirements for monitoring, analysing and mitigating power quality and harmonics problems in their organisations.

This will help the organisation to improve its effectiveness in ensuring a compliant and reliable electrical service.

Personal Impact:

Upon completion of this course, a participant should be able:

- To review factors those contribute to power quality problems.
- To explore Power System Harmonics concepts, causes, and solutions.
- To review the study of Harmonics and its problems in depth.
- To find solutions available to solve power quality problems
- To describe the processes that many utilities and customers are employing to prevent, identify, and solve these problems

Who Should Attend?

This course is intended for technicians and engineers responsible for the identification and correction of power quality and harmonic problems in commercial and industrial facilities.

Course Outline:

Day 1: Introduction to power quality problems

- Electrical Disturbances
- Short Duration Voltage Variations
- Long Duration Voltage Variations
- Voltage Imbalance
- Wave Form Distortion
- Voltage Fluctuations
- Power Frequency Variations

Effects of Disturbances on Equipment and Processes

Industry Commitment to Power Quality

IEEE Standards and Recommendations

Day 2: Harmonics

Harmonic Sources

- Non Liner Loads
- Single Phase Sources
- Three Phase Sources

Harmonic Analysis

Effects of Harmonic Distortion

Harmonic Monitoring

Harmonic Elimination

Calculation of Harmonic Voltages and Currents

Day 3:

Harmonics Problems

- Sources of harmonic distortion
- Rules for identifying possible problem situations
- System analysis procedures (identifying resonance problems)
- Harmonic issues in commercial facilities
- Solutions to harmonic distortion problems

Harmonic Limit Compliance Evaluations Using IEEE 519-1992

- General Procedure for Applying Harmonic Limits
- Automatic Acceptance
- Comprehensive Limit Compliance Evaluation
- Case Studies

Day 4:

Grounding

- Types of Grounding
- Arcing Ground Faults
- Symptoms of Ineffective Grounding
- Electronics and Computer Grounding
- Voltage Disturbances
- Lightning
- System Switching
- System Faults
- Sags
- Swells

Day 5:

Mitigation Techniques

K-Factor Transformers

Power Line Conditioners

- Passive filters
- Active filters
- Isolation and harmonic reduction transformers

Discussion and Conclusion

Course Methodology:

A variety of methodologies will be used during the course that includes:

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionnaires
- Group Work
- Discussion
- Presentation

Course Certificate:

International Center for Training & Development (ICTD) will award an internationally recognized certificate(s) for each delegate on completion of training.

Course Fees:

To be advised as per course locations. This rate includes participant's manual, Hand-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Timings:

Daily Course Timings:

08:00 - 08:20	Morning Coffee / Tea
08:20 - 10:00	First Session
10:00 - 10:20	Coffee / Tea / Snacks
10:20 - 12:20	Second Session
12:20 - 13:30	Lunch Break & Prayer Break
13:30 - 15:00	Last Session