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Electrical Engineering

Electric Power Quality Monitoring and Mitigation

Course Introduction

Power Quality Monitoring and Mitigation

Power quality is an issue that is becoming increasingly important to electricity consumers at all levels of usage. Sensitive power electronic equipment and non-linear loads are widely used in industrial, commercial and domestic applications leading to distortion in voltage and current waveforms. With ongoing regulatory, policy and structural changes in the Indian electricity industry, following the Electricity Act **2003**, the issue of PQ is poised to become a figure-of-merit amongst the competing distribution utilities. Improvement of PQ has a positive impact on sustained profitability of the distribution utility on the one hand and customer satisfaction on the other.

The main objective of the course is to enhance the knowledge of the participants in the emerging area of power quality and several key issues related to its modeling, assessment and mitigation.

The course will provide a platform to an in-depth discussion on the various challenges and their possible remedies with respect to maintaining power quality in electricity sector, which will benefit participants from academic and R & D institutions, professional engineers from utilities, industries and policy makers.

The course will introduce fundamentals of power quality problems, various causes which create the distortion in the power supply, their mitigation and power quality standards. The course will also cover the application of digital signal processing and artificial intelligence techniques for data compression, feature extraction and classification of disturbances. Besides these, few fault location algorithms will also be discussed. Demonstration of the findings in the recent research work on power quality issues carried out at I.I.T. Kanpur will also be presented.

Target Audience

This course is intended for managers, electrical engineers, utility specialists and senior electrical technical staff who wish to advise end-users on power quality concerns, those

who service large end-users or who wish to understand aspects of network design, construction and maintenance techniques for maximizing quality of supply. Personnel working in all areas of power system design who wish to know how the system interacts with the end-user will also gain from this course.

Learning Objectives

- Apply and gain an in-depth knowledge on electrical power systems quality and troubleshooting
- Discuss the terms and definitions of power quality, power quality evaluation procedure, voltage imbalance, power frequency variations, CBEMA and ITI curves
- Enumerate the different sources of voltage sags and interruptions including the fundamental principles of protection, evaluating the economics of different ride-through alternatives and the utility system fault-clearing issues
- Identify the different sources of transient over voltages, principles & devices for overvoltage protection, utility system lightning protection and computer tools for transients analysis
- Describe the fundamentals of harmonics including the power system quantities under nonsinusoidal conditions, harmonic indices, harmonic sources from commercial & industrial loads and become aware of the effects of harmonic distortion on capacitors, transformers, motors etc.
- Distinguish the applied harmonics, harmonic distortion evaluations, devices for controlling harmonic distortion and the standards on harmonics
- Explain the significance of long duration voltage variations including the principles of regulating the voltage, devices for voltage regulation and regulating utility voltage with distributed resources
- Employ the principles of power quality benchmarking, illustrate the benchmarking process and give emphasis on power quality contracts, power quality insurance and power quality state estimation
- Enumerate the different distributed generation technologies, power quality issues and interconnection standards related to the distributed generation and power quality
- List the resources, reasons for grounding, typical wiring and grounding problems as well as the solutions to these problems
- Carryout the proper procedure for power quality monitoring, application of intelligent systems and become familiar with the power quality monitoring standards

Course Outline

- **DAY 01**

  Module (01) Power Quality Overview

  - 1.1 What is Power Quality
  - 1.2 Why is it Important
  - 1.3 Symptoms of Wiring and Grounding Problems
  - 1.4 Symptoms of Voltage Sag and Interruption Problems
  - 1.5 Symptoms of Harmonic Problems
  - 1.6 Symptoms of Transient Problems
  - 1.7 General Approach

  Module (02) Wiring and Grounding

  - 2.1 Definitions and Terminology Purpose
  - 2.2 Wiring and Grounding for Power Quality
  - 2.3 Typical Problems
  - 2.4 Problem - Local Area Networks
  - 2.5 Problem - High Neutral-Ground Voltages

- **Day 02**

  Module (03) Major Distribution System Power Quality Concerns

  - 3.1 Lightning Protection
  - 3.1.1 Capacitor Switching Transients Magnification
  - 3.1.2 Solutions to Capacitor Switching Problems
  - 3.2 Voltage Sags & Momentary Interruptions
  - 3.2.1 Voltage Sag Characteristics
  - 3.2.2 Impact of System Protection Practices Transmission & Distribution System Analysis
  - 3.2.3 Utility / Customer / Equipment Solutions
  - 3.3 Harmonic Distortion Concerns Harmonic Generation (ASDs, etc.)
  - 3.3.1 Impact on Transformer Heating
  - 3.3.2 Harmonic Filter Design
  - 3.3.3 Harmonic Standards (IEEE 519)

  Module (04) Voltage Sags and Interruption Concerns

  - 4.1 Voltage Sags vs. Outages

- 4.2 Faults on the Transmission System Faults on the Distribution System Motor Starting Events
- 4.3 Equipment Sensitivity (ASDs, Controls) Utility / Customer / Equipment Solutions
- 4.4 Problem - Process Controller Tripping During Voltage Sags
- 4.5 Problem - Voltage Variations Caused by Variable Load 4.8 Converting LV Line to HV Line

• **Day 03**

Module (05) Transient Overvoltage Concerns

- 5.1 What are Transients and Where Do They Come From? Capacitor Switching Transients
- 5.2 Basic Principles of Overvoltage Protection
- 5.3 Arresters and Surge Suppressors
- 5.4 Effect of Chokes and Isolation Transformers
- 5.5 Problem - Nuisance Tripping of ASDs
- 5.6 Problem - Capacitor Switching Transient Magnification
- 5.7 Problem - Voltage Notching
- 5.8 Problem - Transients from PWM Inverters

• **Day 04**

Module (06) Power Quality Monitoring and Site Surveys

- 6.1 Monitoring Objectives Initial Site Survey Monitoring Equipment
- 6.2 Selection Monitoring Locations
- 6.3 Data Collection
- 6.4 Data Analysis

• **Day 05**

Module (07) Long-Duration Voltage Variations

- 7.1 Principles of Regulating the Voltage Devices for Voltage Regulation
- 7.2 Utility Voltage Regulator Application
- 7.3 Capacitors for Voltage Regulation
- 7.4 End-User Capacitor Application
- 7.5 Regulating Utility Voltage with Dispersed Sources

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
June 23, 2025	June 27, 2025	5 days	4950.00 $	Spain - Barcelona
Sept. 1, 2025	Sept. 5, 2025	5 days	4250.00 $	UAE - Dubai
Nov. 10, 2025	Nov. 14, 2025	5 days	4250.00 $	UAE - Abu Dhabi