Modern Electric Power Systems Design, Modelling, Analysis and Problem Solving Training

Description

Course Description

A reliable supply of electrical energy is becoming increasingly important in modern industrial processes. A properly designed power system improves the performance of processes and electrical services throughout the plant. Increased dependence on electrical energy and introduction of new technologies and automation requires that the industrial power system is planned, designed and operated using the best available technology.

Course Objective

- Delegates will gain a detailed appreciation of the following:
- The operation and power flow characteristics of small and large networks and how the network can be so arranged to deliver more real power over the transmission system to load centres.
- The form and use of a range of FACTS devices to improve system operation.
- New CT and VT optical transducers and protection relaying system employing micro processor configured relays.
- Protection systems for thermal monitoring of cable networks.
- Alternative forms of generation and embedded generation. Carbon emissions trading, etc.
- Diagnostic monitoring of plant and in particular GIS substations.
- Advances in power electronics and the application to HVDC links
- High speed fault limiters and real time stability monitors.
- Demand side management

Course Outline

System Planning

- Basic design considerations
- Planning guide for industrial plant design

- Voltage consideration

Fundamentals of power system analysis

- Review of voltage, current, and power in balanced threephase system
- The per unit system
- Electrical machine parameters
- Transformers – Two and three winding transformer models
- Load models
- Electrical characteristics of transmission lines and cables

Short circuit studies

- The purpose of short circuit studies
- Sources of short circuit currents
- Data representation for short circuit calculations
- Basic shortcircuit analysis concepts
- Symmetrical components and sequence networks
- Types of faults
- ANSI/IEC short circuit calculation methods
- Evaluating circuit breaker duty
- Performing shortcircuit studies
- Interpreting shortcircuit study results

Power flow studies

- Data requirements for power flow study
- Formulation of the power flow problem
- Methods for solving the power flow problem
- DC and AC solutions
- Alleviating power flow problems
- Reactive power flow and voltage control
- Reactive compensation of lines and cables
- Voltage collapse
- Power factor correction
- Motor starting studies
- Why do we do MS studies?
- Data requirements for motor starting studies
- Modeling of induction and synchronous motors

Static motor starting studies

- Dynamic motor starting studies
- Alleviating voltage problems during motor starting
- Types of starting devices

Power factor and related considerations

- Reactive power and power system fundamentals
- Capacitor unit and bank ratings
- Protection of capacitors and capacitor banks
- Capacitor switching
- Motor terminal application
- Control of switched capacitors
- Harmonic and circuit resonance

Grounding

- Equipment grounding

System grounding

Ungrounded

Solidly grounded

- High and low resistance grounded
- Selection of system grounding

Specialized studies

- Overview of harmonic analysis
- What are harmonics?
- How harmonics are generated
- How harmonics are amplified
- Effects of harmonics on equipment
- How to eliminate harmonics problems
- Harmonic filters
- Overview of transient stability studies
- Overview of reliability studies