Course 101

Power System Fundamentals I

Course Objectives

The main objective of this course is to review basics of power system structure, operation, and methods of analysis. The course reviews the fundamental methods used in the steady-state analysis of power systems. The concept of three-phase operation and theory of symmetrical components will be introduced. The modeling of power system components including generator, line/cable, transformer, shunt element, and load will be covered. The per unit system and bus admittance/impedance matrix as the basis for most steady state analysis will be discussed. The course will introduce the basics of powerflow and short-circuit analysis.

Following the course, students should be able to,

- Understand the basic physical structure of power system components
- Understand the models used to represent components in powerflow software
- Identify suspicious data
- Understand the basics of powerflow and short-circuit analysis

Course Delivery

The course will be delivered in classroom presentations, aided by computer software including powerflow and short-circuit programs for power system steady-state analysis. The presentation slides will be handed out to the students as the course notes.

Instructor

To be determined.

Recommended Prerequisites

Second year electrical engineering courses or equivalent offered by universities.

Course Outline

Session 1

- Introduction to power systems
  - Power system structure
  - Power generation resources: thermal, nuclear, gas, diesel, wind, etc.
  - Important aspects of power system operation and operating states
  - Sinusoidal steady-state basic quantities and their phasor representation; voltages, currents, power

Session 2

- Modeling of power system components
  - Synchronous generators
  - Power transformers
  - Transmission lines and cables

- Characteristics of loads
- Capacitors, inductors, and SVCs
- Induction motors
- Wind generation

Session 3

- Fundamentals of Power System Analysis
  - Symmetrical components, sequence networks
  - Per-unit system
  - Bus admittance matrix
  - Solution methods for large sets of linear and nonlinear equations

Session 4

- Powerflow Analysis
  - Basics of powerflow analysis
  - Data and modeling requirements
  - Solution methods and options
  - Interpretation of results
  - Power Factor correction and load control
  - Application of powerflow analysis

Session 5

- Short Circuit Analysis
  - Basics of short circuit analysis
  - Data and modeling requirements
  - Solution methods and options
  - Interpretation of results
  - Application of short circuit analysis

Note that the actual contents of this course offered on specific dates may be customized from the above. Please check with Powertech for details.