

Course 301

Generator Testing and Modeling

Course Objectives

The main objective of this course is to build upon what is covered in Power System Fundamentals I and II with respect to generators and their impact on power system operation. This course reviews typical generator types, generator capability curves, limiting factors, and generator controls and protection modeling including prime mover and governor, exciter and AVR, as well as power system stabilizers. NERC and WECC generator testing and model validation program and requirements will also be covered in details.

Course Delivery

The course will be delivered in classroom presentations, aided by computer software for time domain simulation used for the validation of generators and their associated control parameters. The presentation slides will be handed out to the students as the course notes.

Instructor

To be determined.

Recommended Prerequisites

Courses 101 & 102 – Power System Fundamentals I & II.

Course Outline

Session 1

- Generators
 - Energy conversion and the synchronous generator theory
 - Generator terminal characteristics
 - Off-line and on-line operation
 - Reactive power capability (NERC MOD-24, MOD-25)
 - Testing for determination of generator parameters (NERC MOD-12, MOD13)

- Control Systems
 - Control system definitions
 - Block diagram conventions
 - Feedback control & PID control
 - Control systems operating on synchronous generators

- AVR and Excitation Systems (NERC MOD-26)
 - Excitation requirements imposed by the generator and by the power system
 - Common designs - bus-fed static, rotating dc systems, rotating ac systems
 - Automatic voltage regulation (AVR)
 - Reactive current compensation
 - Excitation limiters and relation to generator and system capability
 - Coordinating excitation limiters and protective relays
 - Testing of excitation systems for performance validation and modeling

Session 2

- Power System Stabilizers (PSS)
 - Effect of excitation system on stability
 - Oscillatory stability of machines
 - Design and tuning of PSS
 - Testing of PSS

- Prime Movers
 - Elements of prime movers
 - Hydraulic turbines
 - Steam turbines
 - Gas turbines

- Governors
 - Speed governing
 - Mechanical-hydraulic governors
 - Electro-hydraulic governors
 - Permanent droop
 - Automatic generation control
 - Testing for performance and modeling

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