

Course 201

Power System Dynamics

Course Objectives

This is a 30-hour course covering various aspects of power system dynamics. The students will learn the basics of dynamic characteristics of power system equipment, dynamic performance of power systems, stability, and controls. After completing the course, the students will be able to understand fundamental dynamic behaviour and controls of power systems and to perform basic stability analysis.

Course Delivery

The course will be delivered in classroom presentations, aided by computer simulations. The presentation slides will be handed out to the students as the course notes.

Recommended Prerequisites

Power System Fundamentals I
Power System Fundamentals II
Generator Modeling

Course Outline

Session 1 – 7.5 hours

- Introduction to power system dynamics
- Power system equipment dynamics
 - Synchronous generator
 - Excitation system
 - Turbine and speed governing system
 - Loads
 - Other equipment
 - Performance requirements
- Introduction to power system stability
- Transient stability
 - Basic concepts
 - Modelling requirements
 - Simulation of power system dynamic responses
 - Protective relay performance
 - Case studies

Session 2 – 7.5 hours

- Small signal stability
 - Basic concepts
 - Modelling requirements
 - Method of analysis – time-domain simulation
 - Method of analysis - modal analysis
 - Case studies

- Voltage stability (dynamic perspective)
 - Basic concepts
 - Modelling requirements
 - Simulation of mid- and long-term power system dynamics
 - Complementary use of static and dynamic methods in voltage stability analysis
 - Case studies

- Frequency stability
 - Basic concepts
 - Modelling requirements
 - Methods of analysis
 - Case studies

Session 3 – 7.5 hours

- Power system controls - I
 - Transient stability enhancement

- Power system controls - II
 - Power system stabilizers

- Power system controls - III
 - Tie line control
 - AGC

Session 4 – 7.5 hours

- Defense plans against extreme contingencies
 - Special protection systems (SPS)

- Dynamic security assessment of power systems
 - Security criteria
 - Methods of analysis
 - Determination of stability limits
 - On-line applications