



Consulting and Training | Reach New Heights

Course Name

Power System Reliability & Security

Sector Name

Electrical Engineering

Document Type

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Power System Reliability & Security

Course Introduction

Power Systems

This course presents the basic concepts, topics, and indices, outage models of system components, phenomena, and three specific issues in probabilistic system operation reliability assessment. The operation reliability of Power Systems includes adequacy and security evaluations for real-time operation from a few minutes to half an hour, and operation planning from half an hour up to a year. There are fundamental differences between reliability assessments for operation and long-term system planning.

The main features of operation reliability assessment are illustrated, and 13 topics in this course are explained. The indices for system operation reliability can be classified into three categories: the indices of system operation states, limit violations, and system operation risks. The major challenges in system operation reliability assessment include probabilistic simulations of various operational measures, remedial actions, and system dynamics at different timescales, as well as special requirements in input data and computing speed.

Probabilistic reliability assessment of power system operation is an important task for power system researchers and engineers today

and in the future. This course will refresh the knowledge of specialists from the power industry in reliability concepts and applications, present the state of the art, methodologies, and allow them learning from problem-solving and group discussions. The course gives the most recent perspectives on all aspects related to reliability assessments and security of the power system in the ever-changing world of intermittent generation, flexible demand, and power electronics.

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Target Audience

- ✓ Circuits Engineer
- ✓ Design Engineer
- ✓ Electrical Controls Engineer
- ✓ Electrical Design Engineer
- ✓ Electrical Engineer

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Learning Objectives

- ✓ Understanding of the Reliability Regulatory Framework
- ✓ Be aware of the Reliability Standard and Hierarchical Model
- ✓ Assessment of Power System Reliability and understanding Outage Management.
- ✓ Understanding Reliability and Availability of Repairable Equipment in Power Systems.
- ✓ Learn how to assess the Adequacy of the Generation System through Utility Models.
- ✓ How to apply the decision Tree Methods for Complex Power Systems, and how to utilize FMEA and FMECA?
- ✓ Understating IEEE Standards in indices for Generation Units.

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Course Outline

✓ DAY 01

Module (01) Reliability: Regulatory Framework

- ✓ Introduction
- ✓ NERC, NPCC
- ✓ Loss of Load Probability (LOLP)
- ✓ Loss of Load Expectation (LOLE)
- ✓ Generation Reserve Requirements
- ✓ Operating Reserve
- ✓ Flexible Reserves with Intermittent Resources

Module (02) Reliability Standards

- ✓ Impact of Interconnections on System Reliability
- ✓ Reliability and Security
- ✓ Hierarchical Model

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Course Outline

✓ Day 02

Module (03) Reliability Assessment

- ✓ Resource Adequacy
- ✓ Transmission Adequacy
- ✓ Demand Forecast
- ✓ Outage Management

Module (04) Applied Reliability

- ✓ Probability Distributions
- ✓ Estimation
- ✓ Fitting Methods
- ✓ Serial/ Parallel systems

Module (05) Reliability Assessment

- ✓ Concept of Reliability
- ✓ Reliability Function
- ✓ Common Distributions in Component Reliability
- ✓ Component Reliability Model Selection

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Course Outline

✓ Day 03

Module (06) Markov Processes

- ✓ Markov Process
- ✓ State space diagram
- ✓ The bathtub hazard function
- ✓ Data collection in power generation plants

Module (07) Frequency and Duration Method

- ✓ Frequency and Duration Technique
- ✓ Mean duration of individual states
- ✓ Mean Duration of States

Module (08) Rel. /Availability of Repairable Equipment

- ✓ Large example and building blocks
- ✓ Monte Carlo Method 8.3 Root Cause Analysis

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Course Outline

✓ Day 04

Module (09) Utility Models to Assess Adequacy of the Generation System

- ✓ Generating Units Characteristics
- ✓ Variable Volume: Run of the River Plants
- ✓ Heat Rates
- ✓ Deratings
- ✓ Failure Rates
- ✓ Maintenance Patterns
- ✓ Operating Modes
- ✓ Markov Models and Unit Characteristics
- ✓ Unit Scheduling and Dispatch

Module (10) Decision Tree Methods

- ✓ Decision Tree Analysis
- ✓ Bayesian Decision Trees
- ✓ FMEA 10.4 FMECA

Module (11) Fundamentals Models

- ✓ Major Generating Units Databases: UNIPED, GADS
- ✓ IEEE Standards on indices for Generating Units

- ✓ Chronological Models
- ✓ GE-MARS
- ✓ Hydroelectric Generating Units, Fossil Generating Units, Nuclear Generating Units

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Course Outline

✓ Day 05

Module (12) Power System Reliability

- ✓ Generation Adequacy
- ✓ Transmission Adequacy
- ✓ System- Historical Reliability Methods applied to PS
- ✓ Parameter Uncertainty
- ✓ Perception and Acceptability
- ✓ Failure Data Analysis Generation Revenues/ Probabilistic Production Costing
- ✓ Effects of Market Uncertainty, Supply & Demand Management

Module (13) A New Control Method for Grid Assets

- ✓ The Virtual Synchronous Machine Concepts
- ✓ Control Description
- ✓ Virtual Inertia
- ✓ Frequency Dependency
- ✓ Integrated Selective Continuous Load Shedding
- ✓ Non-Load Converter Systems
- ✓ Inactive Converters

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Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
April 25, 2027	April 29, 2027	5 days	4250.00 \$	KSA , Riyadh
Jan. 18, 2027	Jan. 22, 2027	5 days	5950.00 \$	USA , Texas
Aug. 23, 2027	Aug. 27, 2027	5 days	4250.00 \$	UAE , Dubai
Nov. 29, 2026	Dec. 3, 2026	5 days	4250.00 \$	Bahrain , Manama

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