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THE LEADING TRAINING PROVIDER

Electrical Engineering

Power System Reliability & Security

Course Introduction

Power Systems

This course presents the basic concepts, topics, and indices, outage models of system components, phenomenon, and three specific issues in probabilistic system operation reliability assessment. 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 year. There are fundamental differences between reliability assessments for operation and long-term system planning.

The main features in 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 engi- neers today and in the future. This course will refresh the knowledge of specialists from the power industry in reliability con- cepts and applications, present state of the art, methodologies and allow them learning from problem solving and group discussions. The course gives 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.

Target Audience

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

Learning Objectives

- Understanding of Reliability Regulatory Framework
- Be aware with Reliability Standard and Hierarchical Model
- Assessment of Power System Reliability and understanding Outage Management.
- Understanding Reliability and Availability of Repairable Equipment in Power System.
- Learn how to assess 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.

Course Outline

- **DAY 01**

  Module (01) Reliability : Regulatory Framework

  - 1.1 Introduction
  - 1.2 NERC, NPCC
  - 1.3 Loss of Load Probability (LOLP)
  - 1.4 Loss of Load Expectation (LOLE)

- 1.5 Generation Reserve Requirements
- 1.6 Operating Reserve
- 1.7 Flexible Reserves with Intermittent Resources

Module (02) Reliability Standards

- 2.1 Impact of Interconnections on System Reliability
- 2.2 Reliability and Security
- 2.3 Hierarchical Model

• **Day 02**

Module (03) Reliability Assessment

- 3.1 Resource Adequacy
- 3.2 Transmission Adequacy
- 3.3 Demand Forecast
- 3.4 Outage Management

Module (04) Applied Reliability

- Models 4.1 Probability Distributions
- 4.2 Estimation
- 4.3 Fitting Methods
- 4.4 Serial/ Parallel systems

Module (05) Reliability Assessment

- 5.1 Concept of Reliability
- 5.2 Reliability Function

- 5.3 Common Distributions in Component Reliability
- 5.4 Component Reliability Model Selection

• **Day 03**

Module (06) Markov Processes

- 6.1 Markov Process
- 6.2 State space diagram
- 6.3 The bathtub hazard function
- 6.4 Data collection in power generation plants

Module (07) Frequency and Duration Method

- 7.1 Frequency and Duration Technique
- 7.2 Mean duration of individual states
- 7.3 Mean Duration of States

Module (08) Rel. /Availability of Repairable Equipment

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

• **Day 04**

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

- 9.1 Generating Units Characteristics
- 9.2 Variable Volume: Run of the River Plants
- 9.3 Heat Rates
- 9.4 Deratings
- 9.5 Failure Rates
- 9.6 Maintenance Patterns
- 9.7 Operating Modes
- 9.8 Markov Models and Unit Characteristics

- 9.9 Unit Scheduling and Dispatch

Module (10) Decision Tree Methods

- 10.1 Decision Tree Analysis
- 10.2 Baysean Decision Trees
- 10.3 FMEA 10.4 FMECA

Module (11) Fundamentals Models

- 11.1 Major Generating Units Databases: UNIPEDE, GADS
- 11.2 IEEE Standards on indices for Generating Units
- 11.3 Chronological Models
- 11.4 GE-MARS
- 11.5 Hydroelectric Generating Units, Fossil Generating Units, Nuclear Generating Units

• **Day 05**

Module (12) Power System Reliability

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

Module (13) A New Control Method for Grid Assets

- 13.1 The Virtual Synchronous Machine Concepts
- 13.2 Control Description
- 13.2.1 Virtual Inertia
- 13.2.2 Frequency Dependency
- 13.2.3 Integrated Selective Continuous Load Shedding
- 13.2.4 Non-Load Converter Systems
- 13.2.5 Inactive Converters

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
April 13, 2025	April 17, 2025	5 days	4250.00 $	KSA - Riyadh
Aug. 11, 2025	Aug. 15, 2025	5 days	4950.00 $	England - London
Nov. 23, 2025	Nov. 27, 2025	5 days	4250.00 $	Bahrain - Manama