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Course Name

Power Optimization of Energy Management System in Modern Power Generation Industry

Sector Name
Electrical Engineering

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Power Optimization of Energy Management System in Modern Power Generation Industry

Course Introduction

Power Optimization of Energy Management System

The efficient and economically optimal operation of electric power generation systems has always been a cornerstone of the power industry. Historically, fuel costs accounted for approximately **20%** of total revenues for U.S. electric utilities. However, the oil embargo of **1973** and subsequent fuel price escalations have intensified the need for advanced optimization techniques in power system operations.

This course addresses critical engineering challenges that have gained renewed importance in recent years. While traditional economic dispatch problems for thermal systems were solved decades ago, the advent of deregulated markets, advanced computational tools, and sophisticated algorithms has transformed the landscape. Today, power system optimization involves not only optimal dispatch but also pricing commodities, market settlements, and hedging strategies.

This course provides a comprehensive, skill-building overview of optimization techniques, including linear and nonlinear methods, optimal power flow, locational marginal pricing, and auction-based

hedging instruments. It is designed to equip power professionals with the knowledge and tools needed to succeed in today’s dynamic and competitive energy markets.

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Target Audience

✓ Electrical Engineers

✓ Power Systems Engineers

✓ Design and Project Engineers

✓ Controls and Instrumentation Engineers

✓ Reliability Engineers

✓ Test and Research Engineers

✓ Power Distribution Engineers

✓ Technicians and Analysts in the Power Sector

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Learning Objectives

- ✓ Apply up-to-date knowledge and skills in power system optimization and energy management.
- ✓ Analyze the characteristics of power generation units and their impact on transmission systems.
- ✓ Solve economic dispatch problems for thermal units using advanced methods.
- ✓ Understand unit commitment strategies and generation with a limited energy supply.
- ✓ Develop and interpret production cost models.
- ✓ Evaluate power interchange and its economic implications.
- ✓ Implement power system security measures and state estimation techniques.
- ✓ Solve optimal power flow problems using modern optimization algorithms.

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Course Outline

✓ DAY 01

Module 1: Characteristics of Power Generation Units

- ✓ Characteristics of Steam Units
- ✓ Variations in Steam Unit Characteristics
- ✓ Cogeneration Plants
- ✓ Typical Generation Data

Module 2: Economic Dispatch of Thermal Units

- ✓ The Economic Dispatch Problem
- ✓ Dispatching with Network Losses
- ✓ Lambda-Iteration Method
- ✓ Gradient-Based Methods
- ✓ Piecewise Linear Cost Functions
- ✓ Dynamic Programming Applications
- ✓ Base Point and Participation Factors
- ✓ Economic Dispatch vs. Unit Commitment
- ✓ Optimization with Constraints

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Course Outline

✓ Day 02

Module 3: Transmission System Effects and Unit Commitment

- ✓ Power Flow Problem and Solutions
- ✓ Transmission Losses
- ✓ Input Data for Power Flow Analysis
- ✓ Hydro and Fuel Constraints
- ✓ Unit Commitment Solution Methods
- ✓ Dual Optimization for Nonconvex Problems

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Course Outline

✓ Day 03

Module 4: Generation with Limited Energy Supply

- ✓ Introduction to Limited Energy Supply
- ✓ Take-or-Pay Fuel Contracts
- ✓ Composite Generation Models
- ✓ Gradient Search Techniques
- ✓ Handling Hard Limits and Slack Variables
- ✓ Fuel Scheduling via Linear Programming

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Course Outline

✓ Day 04

Module 5: Production Cost Models

- ✓ Introduction to Production Cost Modeling
- ✓ Types and Applications of Production Cost Programs
- ✓ Probabilistic Production Cost Models
- ✓ Sample Computations and Exercises
- ✓ Probability Methods in Generation Planning

Module 6: Interchange of Power and Energy

- ✓ Economy Interchange between Utilities
- ✓ Evaluation of Economic Energy Transactions
- ✓ Interchange with Unit Commitment
- ✓ Multi-Utility Transactions
- ✓ Power Pools and Their Role
- ✓ Transmission Effects and Challenges
- ✓ Transactions with Nonutility Parties

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Course Outline

✓ Day 05

Module 7: Power System Security and State Estimation

- ✓ Factors Affecting Power System Security
- ✓ Contingency Analysis and Network Detection
- ✓ Introduction to State Estimation
- ✓ Weighted Least-Squares Estimation
- ✓ Orthogonal Decomposition Methods
- ✓ Applications of State Estimation
- ✓ Optimal Power Flow Solutions
- ✓ Linear Sensitivity Analysis
- ✓ Security-Constrained Optimal Power Flow
- ✓ Interior Point Algorithms
- ✓ Bus Incremental Costs

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Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
Jan. 25, 2027	Jan. 29, 2027	5 days	4250.00 $	UAE , Dubai
June 29, 2026	July 3, 2026	5 days	4250.00 $	UAE , Dubai
Sept. 14, 2026	Sept. 18, 2026	5 days	4250.00 $	UAE , Dubai
Dec. 20, 2026	Dec. 24, 2026	5 days	4250.00 $	Oman , Muscat
Dec. 28, 2026	Jan. 1, 2027	5 days	4950.00 $	Austria , Vienna

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