Introduction

This program provides a detailed understanding of power generation systems focusing on gas turbines, wind turbines, solar power, and combined-cycle power plants. It encompasses the components, design, operation, maintenance, and economics of steam power plants, cogeneration systems, and renewable energy technologies.

Participants will gain insights into components such as compressors, turbines, heat recovery steam generators, deaerators, condensers, lubrication systems, instrumentation, control systems, transformers, and generators. The course also addresses significant advancements in cogeneration and renewable energy systems over the last two decades.

The integration of modern technologies in power generation, including cogeneration and renewable energy, has revolutionized electricity production. This program emphasizes power system training and maintenance, preparing participants to tackle challenges in contemporary industrial power generation systems effectively.

Targeted Groups

This course is tailored for:

- Power Station Operators, Technicians, Engineers, and Managers.
- Electrical and Mechanical Engineers of all competency levels.
- Project Engineers and Project Managers.
- Power Station Maintenance Crews.

Course Objectives

By the end of the course, participants will:

- Understand the components and subsystems of gas turbines, steam power plants, cogeneration systems, combined cycles, wind turbines, and solar power systems.
- Analyze the advantages, applications, performance, and economics of various power generation systems.
- Learn about critical equipment, including compressors, turbines, transformers, and generators.
- Discover maintenance strategies to enhance the efficiency, reliability, and lifespan of power systems.
- Monitor and control environmental emissions.
- Explore predictive and preventive maintenance techniques.
- Gain expertise in selecting and applying cogeneration, combined cycles, wind turbines, and solar power systems.

Targeted Competencies

Participants will build competencies in:

- Power generation theory.
- Understanding different power plant types and their features.
- Industrial plant processes and control measures.
- Thermal, gas, and diesel power plant operations.
- Electric machines, drives, and control devices fundamentals.

Course Content

Unit 1: Steam Power Plants

- Thermodynamics principles review.
- Fire-tube and water-tube boilers.
- Steam drums, superheaters, reheaters, and turbines.
- Efficiency and heat rate concepts.
- Supercritical plants and cogeneration systems.
- Economics of cogeneration plants.

Unit 2: Steam Turbines and Auxiliaries

- Types of turbines and compound turbine systems.
- Turbine control systems and protective devices.
- Maintenance strategies for turbines.
- Heat exchangers, condensers, and lubrication systems.
- Turbine balancing, vibration analysis, and reliability enhancements.

Unit 3: Gas Turbines and Compressors

- Fundamentals of gas turbines and their design.
- Gas turbine calculations and combined-cycle operations.
- Compressor technologies and performance.
- Centrifugal compressors: components, balancing, and surge prevention.
- Advanced sealing mechanisms and magnetic bearings.

Unit 4: Cogeneration Plants, Wind, and Solar Power Generation

- Applications and economics of cogeneration and combined cycles.
- Case study: University of Toronto’s cogeneration plant.
- Wind power generation systems and economics.
- Brushless double-feed generators for wind turbines.
- Solar photovoltaic technologies and economics.

Unit 5: Transformers and Generators

- Fundamentals of electric systems.
- Transformer components and maintenance.

- AC machine fundamentals and synchronous generators.
- Generator testing, inspection, and maintenance.

Conclusion

This program equips participants with the knowledge and skills needed to excel in power generation across various technologies. Whether focusing on conventional systems or renewable energy sources, attendees will be well-prepared to optimize power plant performance, ensure reliability, and contribute to sustainable energy development.